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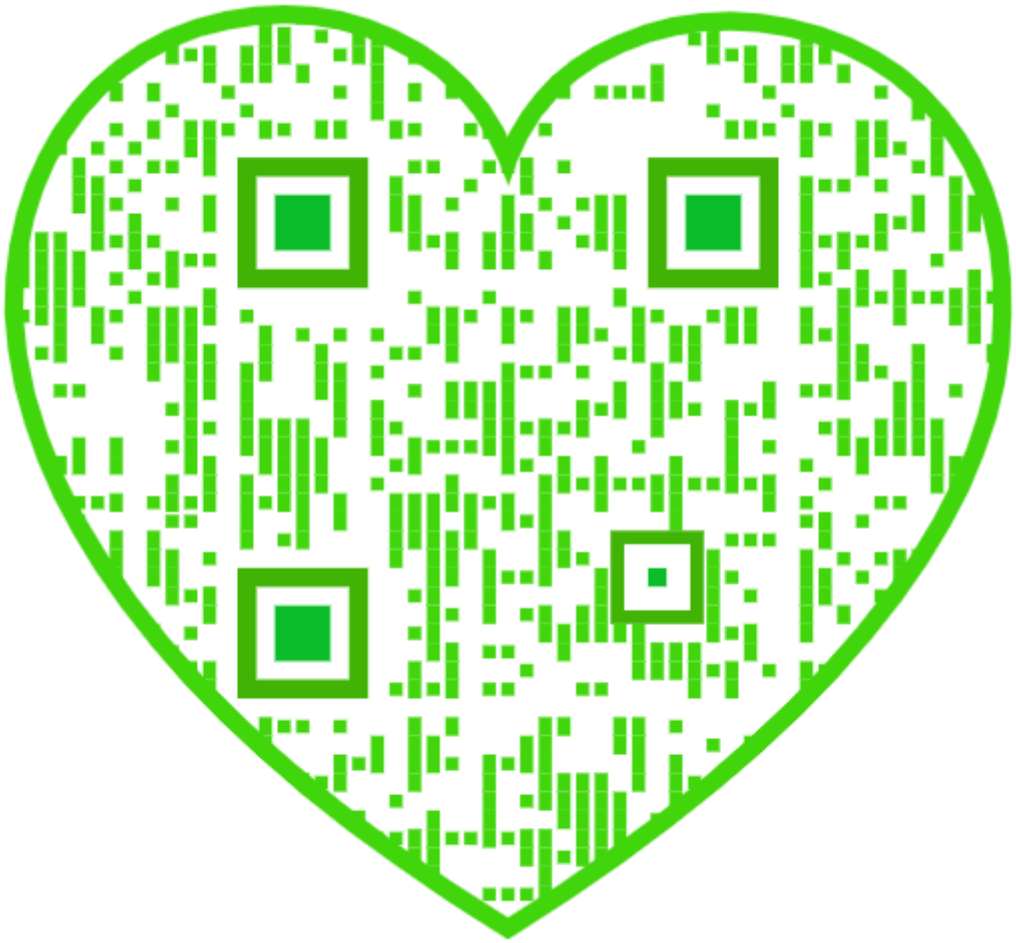

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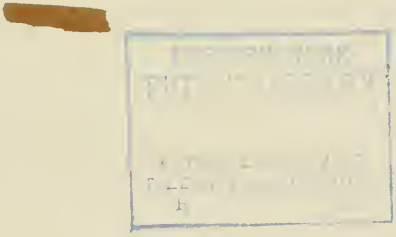


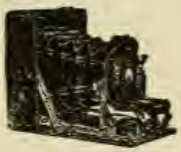
VALAMBROSA
Made in Florence, Italy, by Wm. H. Phillips.
(See Page 369)

American school of art and photography, Chicago

Library of Amateur Photography

VOLUME I

Elementary Photography



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PREFACE

BACK in the 70's of the last century—not so many years ago, after all—photography was in its infancy and but little practiced by the general public. The few professionals who made it their regular business prepared most of their own materials, plates, papers, etc., and the results were frequently very uncertain, as they depended largely upon local conditions, and on the skill and knowledge of the operator. Photography as applied today to the arts and sciences was unheard of. Now, there is hardly a science, industry, or enterprise of any account undertaken that photography, in some form or other, does not enter into. It is invaluable as an aid to research, study, and to the diffusion of knowledge. It has extended its influence far beyond the limits of a popular science, into a world-embracing industry. It is an Art; it is a part of every science. It has revolutionized the art of printing. The magazine and book illustrations, the depicting of current events in the newspapers, the beautiful half-tones, photogravures and three color reproductions that have brought the world's master pieces of Art into our homes, are all the result of photographic process as applied to printing. Its products are the only universal language, understood by all the people of the earth. It has preserved, in facsimile, the world's most valuable manuscripts. In Medicine and Surgery, a

greater knowledge of the human body and its component parts has been made possible by X-ray Photography and Photo-Micrography. With the modern dry plates, sensitive to all or any desired colors, photography has become an invaluable ally to the microscope. In Chemistry, Sir William Crookes, by the aid of photospectroscopy and the orthochromatic plate, has added a new metal, monium, to the list of elements. In Botany, the kinetoscope has recorded the varying phases of growing plants. The science of Geology has been enriched by photography in many ways, while Meteorology has been advanced by the study of lightning discharges, and the clouds, in photographs. In Astronomy, photographic plates of eclipses of the sun and moon have given us information heretofore unattainable by telescope alone. Nebulae, asteroids, comets and meteors have been studied; their form, detail and conditions have been revealed; and the astronomer, who could not catch the satellite of Neptune with his telescope, has seen it, with the rings of Saturn, fixed upon his plate. With the spectroscope, photography has helped in the discovery of variable stars, and binaries of the shortest periods have been detected and classified by it. In Schools and Colleges it is a valuable educational appliance. In the Industries, the application of photography is almost unlimited. Its application to the manufacture of tapestries, by furnishing cards for the Jacquard loom, thus putting them within reach of the ordinary man, is well known. As evidence in detecting forgeries, duplicated documents, identifying criminals, and in various other ways, the Courts of all countries accept the photograph. In the late Russo-Japanese war, the camera furnished valuable records. In fact, the application of photography extends to almost every branch of human endeavor.

Its greatest improvements are yet to come. No man or woman, competing seriously for the prizes of life, can afford to be without some knowledge, at least, of the Art-science. Competition, never so sharp as now, demands that all avail themselves of the advantages gained by a scientific and technical training, such as the making of photographs will give. Apart from its value as an aid to success, socially and financially, there is no more delightful and refined pursuit than the making of pictures by photography. The aesthetic element in it lightens the burdens of life and sweetens existence here below for those who appreciate it rightly; and it is for this purpose, and to help others study and master this science, that the "Library of Amateur Photography" is published.

ORIGIN OF THE LIBRARY

THE publication of these volumes is our response to a universal request probably never exceeded in the annals of technical education.

Down through the past successful years of the American School of Art and Photography, the daily intercourse with its thousands of students in all parts of the world has been incessantly punctuated with earnest requests for a standard library of photography.

It was generally recognized that from no other source could there emanate such a comprehensive contribution to photographic advancement.

This library is the result of the concentrated experience of every department of the American School of Art and Photography in the instruction of its vast number of students residing in every section of the civilized earth—an experience which enables the treatment of every feature of camera craft with a knowledge of world-wide conditions.

Of course, in the preparation of such a voluminous work of education and reference, constant recourse has been had to the knowledge of the highly trained specialists who assist in the operation of the far-reaching educational system of the American School of Art and Photography.

The illustrations supplied for this library have been furnished by the leading professional and amateur photographers of the country. They present an admirable object lesson and a good history of the art of photography as it is practiced today in the United States.

Interesting data regarding the method of their production and how to understand and enjoy them will be found at the end of each volume.

INTRODUCTION

THE "Library of Amateur Photography," complete in four volumes, has been published in response to an extensive demand from amateur workers, who want a complete treatise of practical instruction on the subjects vitally important from their standpoint. These volumes are the outcome of years of experience in teaching thousands of ambitious photographic workers residing in all parts of the world.

Volume I is intended specially for the beginner who wants to grasp quickly the fundamental principles and laws by which the art of photography is governed. But this volume will also prove of great interest and worth to the most advanced worker, because all of the essential details are so briefly, yet practically, explained that he is made acquainted with "short cuts" which will save much time and material. Every chapter will be found absolutely practical, yet no attempt has been made to exhaust each subject. The aim is to give the beginner a general idea of photographic principles, and to acquaint him with the various types of cameras, as well as demonstrate the action of light and train him to make negatives of value—to properly expose and develop the plate—and to produce practically perfect prints without the disheartening failures which mean waste of material—money thrown away.

Volume II goes into detail on Negative Making, Printing, Copying, Enlarging and Retouching. The instruction in retouching embraces the more elementary work and gives enough

practical training to enable any one to remove imperfections and blemishes not only on portraits, but also on commercial and landscape negatives.

Volume III deals with Architectural Photography, Landscape and General View Photography, as well as composition along all general lines. This volume also gives graphic and practical instruction on Outdoor Photography, while Volume IV is particularly intended for the amateur who wants to make his camera pay its way. To accomplish this the instruction is arranged along the lines of At-Home Portraiture, Commercial Photography, Catalog, Magazine and Advertisement Illustrating, Construction Work and Press Photography.

A special feature of this Library, and one worthy of close attention, is the data covering difficulties and failures in photography. These difficulties have been condensed and revised by the Instruction Department of the School, and cover the experience of thousands of students.

To the practical worker in photography the immense value of this reference work will be apparent. It gives the practical knowledge of experts—instead of the experience of only a few photographers, as is usually the case with most hand books.

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STREET PERFORMANCE

STUDY NO. 1—See Page 369

BY GRACE E. MOUNTS

CHAPTER I.

The Meaning of Photography—Its History.

1. Photography is the art of producing images of objects by the agency of light. Such images may be made on many different materials by direct contact of the object to be imaged with a sensitive surface; or the image may be projected on the sensitive surface, by the aid of a lens. The underlying principle is the same in both cases, though the manipulations are different. The first mentioned method is that characteristically used in photographic printing processes; the second in the making of photographic negatives.

2. The effect of light on certain substances is to induce chemical changes in them which alter their properties. Many hundred such substances have been noted, and others are being added to the list continually. Those which are useful in photography may be roughly grouped under the general heads of *first,* gums and resins; *second,* the salts of various metals, chiefly those of the silver-platinum group.

3. A familiar example of the chemical action of light is the fading of colored paper in parts exposed to sunlight, while protected parts are unchanged from the original hue. Instead of fading, or becoming lighter, the reverse effect may take place, the exposed parts becoming darker. These results are due to some chemical employed in making or in

tinting the paper. The "Indelible Ink" used in marking white cloth is colorless when fresh, and turns black by exposure to light. This is chiefly due to the fact that the "ink" really consists of a solution of silver nitrate, a salt very readily darkened by light.

4. If a freshly made solution of gum arabic in water is made and enough to form a thin film is poured into a flat-bottomed saucer, it may be allowed to dry in the dark. Place a coin in the center of the dried film, and set the dish where it will receive the overhead rays of the sun for an hour at mid-day. If then the coin be removed, and the film be held under a gentle flow of luke-warm water, the circular patch of gum that was underneath the coin, and thus protected from the light, will readily dissolve and be washed away. The remainder which received the full rays of the sun no longer dissolves readily, but requires warmer water or a longer washing to remove it. In this case the action of light has altered the property of solubility, although this alteration was not outwardly apparent, but "developed" only when the luke-warm water was applied.

5. If lampblack had been mixed with the gum arabic solution, and the washing arrested when the soluble part was gone, the image would be white (the color of the saucer), with a black border formed by the remaining gum with the lampblack mixed. If chalk had been used instead of lampblack and a black saucer instead of a white one, under the same conditions a black image surrounded by white would result. These experimental results are of importance as giving the key to many modern methods of photographic printing and other processes.

6. If a piece of sensitized Ferro-Prussiate paper

("blue-print" paper) is exposed to daylight for a short time, and then developed by immersion in water, the sensitized side will turn blue all over. If another piece is similarly exposed under a drawing made with black ink on tracing-cloth (which is almost transparent), the inked side next the sensitized paper surface, and immersed in water, only those parts of the surface that were not under the black lines turn blue; the parts that were protected by the black ink are unchanged and wash away, leaving the image of the lines showing white on a blue ground. In this experiment the tracing cloth, with inked lines, was used as a "negative" for producing the print or "positive."

7. "Negatives" made by photography involve exactly similar principles. As a matter of convenience, photographic negatives are usually made from an image of the object which is greatly reduced in size, by the intervention of a lens in a miniature "camera obscura." Some light-sensitive material is spread upon a support, preferably transparent, for greater facility in subsequent "printing" operations, and the light is allowed to act under suitable conditions. The results of this action are "developed" to a certain point, the development arrested and the unacted on material removed or rendered inactive; this latter operation constituting the "fixing" of the negative. From the negative thus produced, positive images or prints may then be reproduced in any required quantity, by the same or other processes.

8. Negative making or printing involves the principles of photography; whatever special applications may be made of these principles.

HISTORICAL.

9. The story of photography is that of a dream come true—a fancy transmutted into fact.

Whoever was the first to wonder why the image of the summer clouds in a woodland pool, or his own face reflected in his shield of burnished copper, might not be fixed there—such a one was, in spirit, the first photographer. Around some such fancy, legends grew; of magic mirrors that would show scenes at a distance; of charmed basins that held, in the water that filled them, grewsome pictures.

10. Then came the practical people—still under the inspiration of the dream, working it out toward realization, in separate ways, until another, assembling the scattered materials combined them into a step, leading up to the door which at last was reached and opened on the wide and ever widening field.

11. Combining as it does the practical application of optics—the science of the nature, properties and transmission of light—and chemistry, which treats of the changes in material bodies arising from alterations in their composition, it must be the case that the early events in the chain leading up to final achievement have occurred at irregular intervals, and often without their influence or possible bearing being realized or even suspected. Many books like this would fail to cover all the details of the complete story; only the briefest summary of the salient points of interest connected with the origins of photographic negative and positive processes will be admissible here.

12. The first definite stage that we note in the unfolding and completion of present-day photography was

the invention attributed to the Neapolitan philosopher, Giambattista della Porta, of the "Camera Obscura," This he described in his book on "Natural Magic," published in 1569. He admitted a ray of light through a small aperture in the side of an otherwise darkened room, and found that the image of objects on the outside was thrown on the side of the room opposite the aperture, but reversed—top for bottom and left for right. He also found that a double-convex lens, placed in the aperture, would make the shapes and colors more distinct. This apparatus is the basis of all modern photographic cameras. Instead of the photographer being within the camera, as Porta was, he views the image through a sheet of ground-glass forming one side of it—unless he chooses to dispense with the actual inspection of the image, as he is compelled to by the construction of the majority of hand cameras. With these, a miniature camera, a focusing scale or similar device is employed to secure the focusing and arrangement of the view.

13. Fabricius, in 1556, found that silver chloride, which occurs as an ore, called "Horn Silver," in certain silver mines, turned dark by exposure to light. He prepared the silver chloride artificially, and noted that this compound, white when freshly prepared, likewise turned black by exposure. But he was interested in other matters and made no use of this discovery.

14. Not until 1727 was any application made of this property of darkening in the light which belongs to silver salts in general. In that year Schulze, a German chemist, mixed powdered chalk with silver-nitrate, filled a clear glass bottle with the mixture, and placed on the outside of the bottle a paper label, lettered in black ink. When, after

exposure to light, the label was removed, it was found that the parts underneath the ink had been unacted on by light, remaining white, while the translucent paper had allowed the light to pass, and blacken the other parts. Thus the letters appeared in white, on a dark ground; until they too, after the removal of the label, turned dark, like the background. This experiment is the basis of most printing processes involving the use of a negative.

15. Thomas Wedgewood and Humphry Davy, in England, worked along the same lines three-quarters of a century later, the results of their experiments having been published in 1802. They coated white paper or white leather with silver nitrate, and printed thereon, using various opaque objects, also paintings on glass, as negatives. They also experimented with the camera obscura and with the solar microscope—an adaptation of Porta's idea. They were foiled, however, by the low sensitiveness of the silver salt and the impossibility of "preventing the unshaded parts of the delineations from being colored by exposure to the day." In other words they were unable to make their prints permanent—to "fix" them.

16. In experimenting with the then new art of Lithography, Joseph Nicephore Niepce about 1813, tried the substitution of metal plates for lithographic stone and the use of a kind of asphalt as a coating. With the idea of saving labor in drawing, he put the asphaltum-coated plate in the camera-obscura and made a long exposure to a sunlit object. The high-lights acted on the asphaltum, making it insoluble; the shadows had no effect, and permitted the coating to be removed by a solvent. The metal plate, treated with acid, was etched away around the parts that had been protected

by the insoluble portions of the coating, and a relief-plate was produced, which could be printed from. Niepce's process, besides giving the suggestion of development of a "latent image," is exactly the same in principle as that now employed in making "half-tone" engraving plates, such as are used in printing the studies and similar illustrations of this book.

17. A prominent scene-painter in Paris, L. J. M. Daguerre, heard of Niepce's experiments, made his acquaintance, and in 1829 formed a partnership with him for working out the idea into practical form. No particular progress had beeen made when Niepce died, in 1833, and Daguerre continued experimenting along his own lines, finally achieving success in 1838. He announced the full details of this, the first successful photographic process, publicly, on August 19, 1839, and was pensioned by the French government for so doing. Daguerre used a polished plate of silver copper, on which a film or iodide of silver was allowed to form, by exposing the silver surface to the vapor of iodine. This coated plate was then exposed in the camera, and developed by the action of metallic mercury vapor. Fixing was accomplished in a solution of common salt.

18. The pictures produced by this process, called, in honor of the inventor, "Daguerreotype," have never been surpassed in delicacy and beauty. They are not really positives, but negatives of exceeding thinness, "backed" by the mirror-like surface of the silver. This is the reason why the earliest daguerreotype pictures are reversed. Thus, in a portrait, if the right hand rested on a table, the daguerreotype would show it as the left. This drawback was overcome by interposing a mirror or a reflecting prism. But the

greatest inconvenience, and one impossible to overcome, was this, that only one plate could be made for each operation; every duplicate required a separate operation.

19. While Daguerre was experimenting in France, another investigator was at work in England, along quite different lines—those of Schulze and Wedgewood and Davy. William Henry Fox-Talbot announced his process in January, 1839, subsequent to the announcements of Daguerre's discovery, though previous to his public divulging of its details.

20. Talbot in his original process used paper coated with silver nitrate and chloride in combination, making prints of opaque objects, as Wedgewood and Davy had done, but fixing them with a solution of common salt. He also discovered that this paper, exposed in the camera for a much shorter time than was needed to produce a visible image, received an impression, a latent image, which could be developed by a solution of nut-galls; and that this image, which was reversed, not only in regard to position, but also to lights and darks, could be used as a negative, from which to produce, by contact, positives, to any required extent. To this process he gave the name "Calotype," and is entitled to the credit of originating, in principle, the method now universal.

21. To John Herschell is due the use of the compound usually termed "Hypo"—really Sodium Thiosulphate—as a fixing agent. This was adopted in practice and its introduction marks an important epoch. Although glass plates had been used incidentally by Wedgewood and others in photographic experiments, the suggestion of their use, instead of paper, in producing negatives, seems to have been Her-

schell's also. The very important "Blueprint" or Ferro-prussiate process, so extensively utilized in modern industrial and engineering work is another of his contributions to photographic progress.

22. The discovery of gun-cotton, in 1846, by Schonbein, was destined to have an important effect on photographic methods, a few years later. Ordinary cotton fibre, treated with "Aqua Regia," a combination of nitric and hydrochloric acids, is so altered in composition as to become soluble. It is interesting to note, in passing, that gun-cotton enters also into the composition of celluloid, the basis of "films."

23. Niepce de St. Victor, a nephew of the original Niepce, using glass plates for the negative support, made them practicable by employing starch and albumen as a medium which adhered closely to the glass surface, while carrying an iodide in combination. This coating was sensitized by application of silver nitrate; development with gallic acid and fixing with potassium bromide completed the process.

24. Blanquart-Everard, in 1848, applied the albumen coating to paper for printing. The albumen acts as a "size" and results in keeping the chemicals and consequently the image, on the surface of the paper, instead of sinking into its substance. The usefulness of "Albumenized paper" for print making secured the wide adoption of this process, the earliest of the "glossy" as distinguished from the "matt" class of printing papers. In 1850 Gustav Le Gray, although not the originator of collodion, used it to replace albumen as a coating and medium. Collodion, the solution of gun-cotton in mixed ethyl-ether and alcohol, leaves a fine trans-

parent coating of film on a glass plate on which it has been poured, the ether-alcohol solvent quickly evaporating.

25. These experimental suggestions and partial successes were combined, in 1851, by Frederick Scott Archer, into practical working shape, as the "Wet Collodion" process. So effective and satisfactory was it that it was everywhere adopted, supplanting Calotype, Daguerreotype and all other "types" for practical purposes and keeping the field almost entirely to itself until about 1880. Its drawback was the condition that the plates must be sensitized by immersion in a nitrate of silver bath and used almost immediately. Whenever exposures were to be made at any distance from studio or work-room, this imposed the necessity of transporting a cumbrous outfit for sensitizing and development in a portable dark-room of some sort. The results, under proper conditions, have, however, never been surpassed by any other process in the prompt and sure production of negatives having perfect transparency in the darks and opacity in the high-lights, together with satisfactory gradation in the intervening "half-tones." The "contrasty" properties of such negatives render them still the mainstay of the photo-engraver today.

26. In 1855 Taupenot suggested the "dry-plate bath" process. He employed "preservatives"—gallic acid, honey and albumen—to prevent the crystallization of the silver nitrate which occurs when a sensitized wet-collodion plate is allowed to dry. This crystallization renders the action of exposure and development uneven, spoiling the result. Other experimenters, at about the same time, employed tannin, sugar, beer, gum, resin, tea, coffee and tobacco and many other substances, as preservatives; but none of the

methods became widely popular, although special workers produced notably successful results in numerous instances.

27. In 1864, Sayce and Bolton published the details of a collodion-emulsion. The principle of this process was the use of the sensitizing agent, the nitrate or other salt of silver, in practically the precise quantity required for the chemical combination that occurred, through the action of light, on exposure. Up to this time it had been the practice to have the silver nitrate in excess. The collodion emulsion could be prepared in bulk and used at convenience for coating glass plates, which were dried and could then be used as required. Many workers contributed to the perfecting of the details of this process, but all their results were superseded by the next advance, the Gelatin-Bromide process.

28. In 1871, Dr. Maddox suggested and worked out the idea of substituting a solution of gelatin in water for the solution of collodion in spirits, combining it with bromide of silver. This suggestion was eagerly taken up by the experimenters and within the next decade the commercial production of gelatin dry-plates on a large scale had become a reality, and the actual popularization of photography, rendering it available to all, had begun.

29. From 1880 to the present time, modifications and improvements, optical, mechanical and chemical, have followed in such bewildering profusion that it is impossible to summarize them, even briefly. They have resulted, on the negative-making side, in wonderfully increased sensitiveness, reducing the necessary time for exposures so that thousandths of a second have become among the commonplace. Where time is not the chief object, then other results,

such as color sensitiveness, are attained. Most recent are the wondrous results obtained by the Lumière color process, attained along new lines of application, and promising far greater advances for the future.

30. Mechanically, the invention of an American, Dr. Goodwin, which substituted for fragile, heavy, rigid glass a support of celluloid, a substance at once flexible, light and tough and practically of equal transparency, has really revolutionized photography on its practical side and rendered it popular to an extent difficult to realize.

31. The practical introduction of this improvement and the countless accessory apparatus, cameras and the like, is to be credited to another American, George Eastman, who has made "Kodak" a household word throughout the world. Indeed, to many thousands of people it involves and comprehends the entire meaning of "Photography." The nature of the material permits of its manufacture in rolls of any desired length, available for one, a half-dozen, or a thousand exposures. By the ingenious application of well known principles, these rolls in the shape of "cartridges" may be put into and removed from suitable cameras in full daylight, without injury to the result.

32. A still more striking instance of the adaptability of such rolls is their use, in quantities measurable only by thousands of miles, for making the negatives and positives employed in one of the latest applications of photography, the Cinematographs or "moving pictures." This use bids fair to overshadow, by comparison, the quantities, already so large, of material required in other photographic fields. And now that cinematographic pictures, closely approximating "natural colors," have been announced as an accom-

plished fact, the mind can scarcely comprehend what further increase this will involve.

33. It cannot be amiss to call the attention of those who may read the foregoing brief survey of the origins and progress of photography to the importance of an acquaintance with its historical side. Not a week passes that does not see some new use or application made of methods that are, by comparison, old; and to those who are ambitious of advancing, as students and practitioners, nothing can be more useful than an acquaintance with what has been done by their predecessors in the field, to whose devoted labors the present day owes its debt for the knowledge it has received from them.

CHAPTER II.

The Camera—How to Operate It.

34. While the above title might indicate that this volume is intended only for the beginner, yet we would advise those who have had some experience, but have possibly begun wrong, to carefully read these instructions. The house that is built on a poor foundation will never withstand the force of the elements, and so it is in photography. Start right. Be sure of your foundation. Then the difficulties which you will assuredly meet as you advance in this most interesting and profitable profession will be readily overcome.

35. In this instruction we will avoid, as much as possible, technicalities and theories. Be honest with yourself in this study of photography, and your own energies, taste and ambition will lead you to success.

36. The camera has now become almost a household necessity. Nearly every home has one or more, yet only about one-third are actually in use. Hardly one-half of the users do their own finishing but depend upon the professional or wide-awake amateur to do finishing for them. The reason for this is plain. When the camera was first purchased they were led to believe that all that was necessary was to point the instrument at the object they wished to photograph, press the bulb or push button and *"presto*

change" the picture was finished. In nearly every instance, they have met with failures. Most of those meeting with success do not readily understand how they attained their success, and when they meet with failure blame the photographer who developed their plates or films, or come to the conclusion that their camera is a poor one. If they have not lost their enthusiasm and are well supplied with worldly goods, they buy a more expensive instrument; perhaps keep on producing indifferent results until they finally become disgusted, place the camera on the shelf, and lose thereby a most interesting source of education, pleasure and profit.

37. This is the reason why, in so many homes there is more than one camera. It also partly accounts for the fact that the out-put of the different manufacturers is growing larger every year and the number of new cameras is steadily increasing.

38. While it is advisable for beginners to have as good an outfit as possible, it is better, however, for them to have a cheap one and to know how to use it intelligently. Many a cheap instrument is condemned because the user is ignorant of its limitations and tries to put it to uses for which it was never intended. The gun that is guaranteed to shoot true at one hundred yards is not expected to do so at three hundred. The same applies to a camera.

39. In this instruction you will be taught what to expect from your camera. You will become thoroughly familiar with its every feature and attachment, to learn how to produce the best possible results. The rudiments of proper lighting, exposure and developing of plates or films, with prepared powders principally, will be thoroughly treated.

40. The knowledge and experience thus gained will be the foundation of your future photographic studies. You will meet with failures and successes. They should teach you to study the reasons for both. Learn to think photographically for yourself. Do not go ahead blindly, but when in doubt, stop and think. Reason out for yourself the why and wherefore of things and you are bound to succeed, overcoming, with ease, difficulties that otherwise seem to be unsurmountable. The frequent difficulties that you will experience in your first efforts will be fully explained at the end of each chapter, under the heading, "Difficulties," and remedies for the same will be suggested. Above everything else study all instruction carefully, and intelligently follow it. As each failure occurs, turn to the "Difficulty" chapter, where you will find your trouble clearly explained and the proper remedy given.

41. While cameras sent out by most manufacturers are furnished with a descriptive booklet, giving general instructions, there may be some points not perfectly clear to the beginner. Since the different types of cameras are so numerous that it is almost impossible to cover them all in detail, we will only describe here the more important parts of the modern instrument.

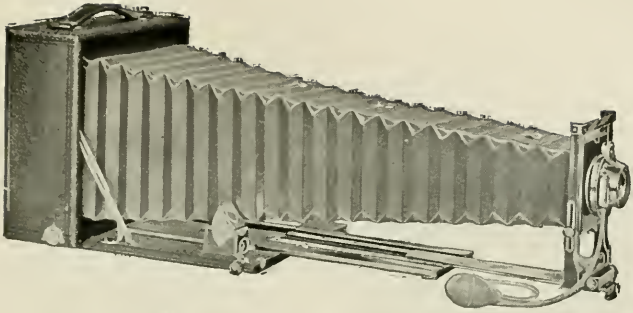
GENERAL DESCRIPTION OF CAMERAS.

42. **Box Cameras.** The Box Camera is the cheapest and simplest of all types of cameras. Some are made for use with films, others for plates, but they are seldom obtainable in sizes larger than 4x5. Box cameras are fitted with single lenses, and the shutters supplied usually allow

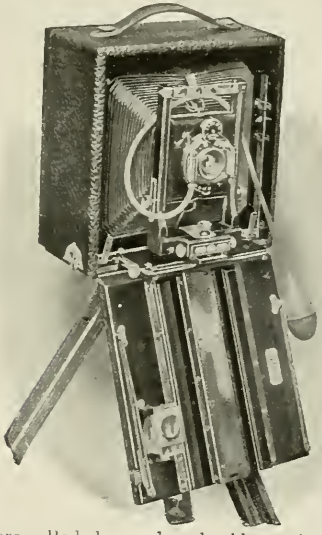
of both instantaneous and time exposures, although there are more elaborate types of box cameras provided with more perfect shutters, giving greater range of exposure. All box cameras are arranged to take pictures both vertically and horizontally, being fitted with finders on both the vertical and horizontal sides. The majority of such cameras have an arrangement for changing the size of diaphragm or lens opening. To effect the movement of the shutter most of these cameras are provided with a lever or button, which, for a time exposure, in the first case must be pushed over in one direction to open the shutter, and back to the original position to close the shutter; or, in the latter case, where a button is provided, it requires one pressure to open the shutter and another pressure to close the shutter. When set for instantaneous exposure one movement of the lever, or one pressure of the button, will cause the shutter to open and close. Any length of time can, of course, be given for a time exposure, while the instantaneous exposure will generally average about 1-33 of a second. Box cameras are not provided with rising front or swing-back attachments. (See Illustration No. 1 of Box Cameras.)

43. **Magazine Cameras.** The Magazine Camera is a form of box camera, but is loaded with a given number of plates that can be dropped into position, one at a time, ready for exposure, by the mere pressing of a button or the pushing over of a lever.

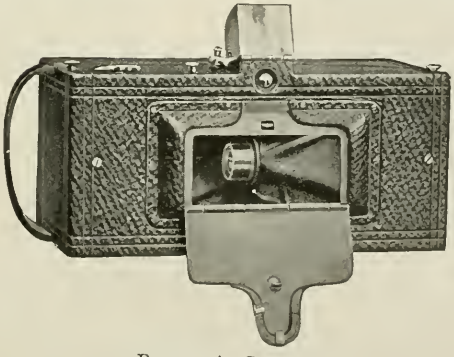
44. **Folding Cameras.** A folding camera is, in effect, a box camera, but with this difference, that the lens support is attached to a collapsible bellows. This bellows, folding into small compass, enables the camera to be made more compact. The front of the camera, on being released by a



A Modern Camera—Bellows Extended



A Modern Camera. Bed dropped and wide angle attachment in use



Panoramic Camera

Illustration No. 1—Box Camera
See Paragraph No. 42

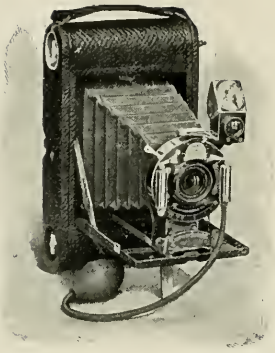


Illustration No. 3—Pocket Film Camera
See Paragraph No. 45

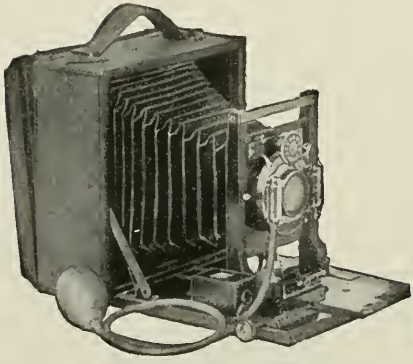


Illustration No. 2—Folding Camera
See Paragraph No. 44

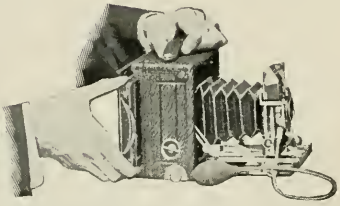


Illustration No. 4—Inserting Film Pack
See Paragraph No. 46

button, drops on its hinges and is held rigidly in position at right-angles to the body of the camera, disclosing a track attached thereto, on which the lens support can be moved in or out, extending or collapsing the bellows according to requirements. The better types of folding cameras are fitted with a rack and pinion on the front of the camera, which enables a very careful adjustment of the lens support. A finder is usually placed on the front board, or attached to the lens support. The lens board in the support is also frequently made to raise or lower, for reasons which are shown in future paragraphs. There are, of course, many other attachments and adjustments on folding cameras, the more expensive types affording greater possibility of movement. (See Illustration No. 2.)

45. **Film Cameras.** Film cameras are practically the same as plate cameras, but are arranged with a particular reference to the use of daylight loading roll films instead of glass plates. They are made in both box and folding types, with all the various adjustments and movements already given in previous paragraphs. As each manufacturer provides a descriptive booklet with each camera he puts out, it will be unnecessary to describe more closely the various workings of the different cameras. The film camera is more generally known as a kodak, in distinction to the plate camera. The operation of the kodak, aside from the manipulation of the film, is practically the same as the plate camera, and the rules regarding focusing and the securing of the proper register of the image are exactly alike. Illustration No. 3 shows a pocket film kodak.

46. **Film-Plate Cameras.** The Film-Plate combination camera is one in which either plates or cut films may be

used. The cut film is put up in the shape of a pack and arranged so that the pack may be slipped into what is known as a *film pack adapter,* a substitute for a plate holder, being the same shape and size. A pack of films may be slipped into, or removed from, the adapter in daylight. Adapters are inserted in the camera in exactly the same manner as the plate holder. Film-plate cameras are provided with adjustments and attachments similar to plate or film cameras, and are operated in the manner previously described. (See Illustrate No. 4 of Film-Plate Camera.)

47. **View Cameras.** The view camera is an instrument not unsimilar to the Folding Camera previously described, but is not made in the enclosed box form of the latter, and its particular purpose is to be used on some form of a support or tripod, as against the folding camera, which is more essentially a "hand camera." In its attachments and method of setting up for use it is almost identical with the folding hand camera, although, generally speaking, the view camera may be considered to have a greater range of use. View cameras are made in all sizes from 4x5 up to 11x14, and larger, whilst folding hand cameras are rarely made in sizes over 6½x8½.

48. **Reflex Type of Cameras.** Another form of camera more recently introduced, yet finding great favor with amateur photographers, is the Reflex type of camera. This is a box form of camera, which is provided with a mirror arrangement in its interior, enabling the worker to see his picture the full size of the plate, the right way up (all ground-glass images obtained in folding and other types of cameras show the image upside down), and visible to the moment of exposure. Such cameras are provided with a

special type of shutter, called the Focal Plane Shutter, which works at very high speeds. The Reflex camera, of which the Graflex and its various prototypes are its best examples, is especially adapted for the photographing of moving objects, children and scenes of everyday life.

49. **Lenses.** The camera, whatever its type, is not complete without a lens. The similar types of cameras are provided with the simpler forms of lenses, the simplest of all being the single, or Meniscus lens, which is generally fitted to box cameras and the cheapest folding cameras of the fixed focus type. The single, achromatic, or view lens, as it is sometimes styled, is limited in its scope. For instance, it is not capable of accurately reproducing lines such as the corners of buildings. It is not a fast lens, and its angle of vision is a narrow one.

50. Of greater general use is the Rapid Rectilinear lens which being made up of two or more lenses attached to each end of the lens barrel belongs to the *doublet type* of lenses. Most hand and film cameras are supplied with such lenses, which are capable of accurately rendering straight lines and give a more or less even definition over the plate for which they are adapted. The single set of lenses of a doublet can be used by itself as a view lens, and then gives an image of twice the dimensions of the doublet lens.

51. For a still further type of lens, which has all the advantages of the rectilinear just mentioned, and adds to these the further advantages of great speed, great brilliancy and fine definition, is the modern or *anastigmat doublet.* Such lenses are of various types, and when fitted to hand, view or reflex cameras enable the worker to do the very highest type of work. For certain forms of work, such as

the photographing of buildings and interior views, where the worker is not able to recede far enough from the object to be photographed, a fourth type of lens is necessary. Such a lens is called the *wide-angle lens,* which is so constructed as to enable the worker to get near to his object and still get it all within the dimensions of his plate.

52. **Shutters.** To enable a picture to be made, some sort of a contrivance is necessary, by which the light can be admitted through the lens for a stated period of time. Such contrivances are called, in general, shutters, and are of varying types—being placed in front of the lens, or between the lens, or behind the lens and in front of the plate, according to their type and the results they are called upon to produce. In box type cameras and the cheaper folding cameras which are fitted with single lenses only, a shutter that works in front of the lens is used, either the simple *rotary shutter,* such as we find on the box type of kodaks and cheap plate box cameras, or the *single valve shutters,* such as are usually fitted to cheaper folding cameras—film or plate. Doublet lenses have the shutter fitted into the barrel midway between the two lens cells. These shutters, being either of the single valve, double valve, or automatic type, work either by pressure on a small external lever or by the pneumatic pressure of a rubber bulb or tube attached to an air valve on the shutter. The remaining type of shutter is that which is commonly fitted to reflex cameras, and consists of an opaque curtain which passes rapidly in front of, and very close to, the sensitive plate, admitting the light through an adjustable longitudinal slot in the curtain. Infinitesimal exposures can be obtained with this shutter, known as the focal plane shutter.

53. **Operating the Shutter.**—The **Rotary Shutter** shown in Illustration No. 5 is automatic in action and always set. It is operated by pressure on a lever, which protrudes from the side of the box. To obtain an instantaneous exposure one pressure of the lever will open and close the shutter simultaneously. By pulling out a small bar or lever projecting from the side of the camera the shutter can be used for time exposure. To obtain a time exposure two pressures of the lever are required—one to open the shutter, admitting the light through the lens, and another to close the shutter, cutting off the light. The diaphragm openings are conrolled by a lever in a similar manner to the time exposure.

54. **The Single Valve Shutters** (See Illustration No. 6) are provided with a dial and a pointer, the dial being marked **T, B, I.** When the pointer is turned to the letter **T** the shutter is then set for what is termed a bulb exposure; the lever or one squeeze of the pneumatic bulb will open the shutter, and a similar movement on the lever or bulb will close the shutter. If the pointer be turned to the letter **B,** the shutter is then set for what is termed a bulb exposure; that is, the shutter will remain open just so long as the lever is held down, or a pressure is exerted on the bulb. Releasing either will instantly close the shutter. The use of the bulb exposure is more particularly for photographing objects which are liable to move, and with which more than an instantaneous exposure is permissible. The **I** on the dial signifies instantaneous, and when the pointer is adjusted to this letter the shutter will work instantaneously when the lever or bulb operates it. The duration of the instantaneous exposure with these shutters is about equivalent to 1-33 of a second.

55. **The Double Valve Shutters** are similar in their work to the single valve shutter, but are more accurately adjusted and supplied with a greater range of movement. Usually the dial is provided with **T** and **B** markings, and from 1 second to 1-100 of a second. To obtain the various exposures the pointer is set to the letter or fraction of a second required. In Illustration No. 7 is shown a standard type of double valve shutter. This shutter is fitted with two levers, lever *C* on the right used for setting the shutter, while the lever *D* on the left is used to release it to make the exposure. The shutter is fitted for a bulb and tube with which the exposure can be made instead of with the finger release. The tubing should be attached to the valve on the left side. On the top of the shutter there is a small dial, containing the letters *B* and *T;* the dial is also marked in figures from 1 to $\frac{1}{100}$, representing seconds and fractions of a second. When the dial, *A*, is turned so that the indicator, *E*, is placed at *T* it means time exposure. To set the shutter pull down lever, *C*. After setting the shutter, one pressure of the bulb or pressing down on the lever or finger release, *D*, opens the shutter and it remains open until the bulb or finger release is again pressed, when the shutter is closed. **Timing exposures.** When the dial is placed at *B* the shutter will remain open as long as the hand presses the bulb or the finger holds down the finger release. It is advisable to use *B*, or the bulb, for all exposures ranging from one-half to two seconds, as it is more simple to operate. For all exposures requiring longer time, the *T* or time exposure should be used. By pressing the bulb once, the shutter is opened and remains open until you again press the bulb when it closes, thus allowing for any length of exposure. When instantaneous or quick exposures are required, then the dial

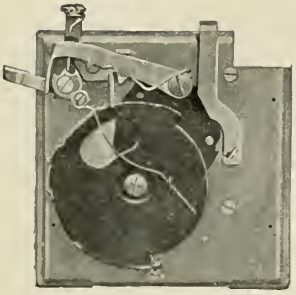


Illustration No. 5.
Rotary Shutter.
See Paragraph No. 53.

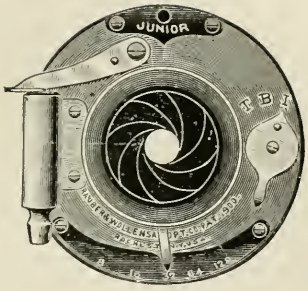


Illustration No. 6.
Single Valve Shutter.
See Paragraph No. 54.

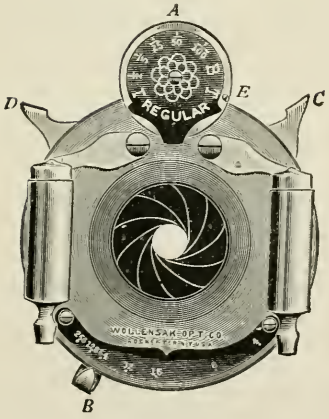


Illustration No. 7.
Double Valve Shutter.
See Paragraph No. 55.

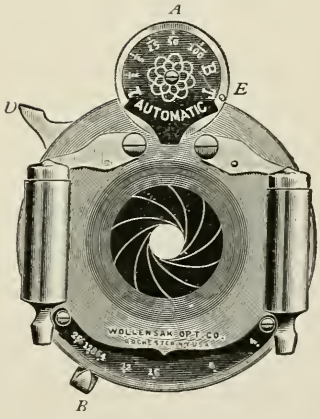


Illustration No. 8.
Automatic Shutter.
See Paragraph No. 56.

should be set at 1-100, 1-50, or 1-25, which indicate fractions of a second. The proper one to use depends on the strength of light. In real bright light 1-100 is best, and in medium light 1-50 or 1-25. When set at 1-100, which is the quickest exposure that can be made with such a shutter, one pressure of the bulb or pressing down of the finger release will make an exposure 1-100 part of a second. When the dial is placed at 1-50, 1-25, 1-5, or 1-2, one pressure of the bulb or pressing down the finger release will give the indicated fraction of a second exposure. **To focus the camera** turn the dial at *T*, set your shutter by pressing down the finger release, *C*, opposite the side from which your tube is attached; then, one pressure of the bulb will open the shutter and permit you to see the image on the focusing screen (ground-glass).

56. **Automatic Shutters** are made of the *single valve* and *double valve* type, and also without any visible valve, and are termed *automatic* for the reason that they are always ready for exposure without having to be "set," as the older forms of single and double valve shutters have to be. The automatic shutter can be seen to have its advantages over the older forms, but at the same time greater care is necessary in seeing that the shutter is not opened inadvertently through a pressure of the bulb, which could not take place with the older shutter before it was set. In Illustration No. 8 is shown a common form of double valve automatic shutter which automatically sets itself after each exposure. The setting of the speed in this class of shutter is practically the same as for the one shown in Illustration No. 7. An indispensible part of all between-the-lens shutters is the diaphragm or stop, which regulates the quantity of light passing through the shutter to the plate or film.

57. **Diaphragms or Stops.** The diaphragm or stop in a shutter is usually an opening which can be regulated from outside the lens barrel, making it larger or smaller in proportion to the amount of light it is desired to admit to the plate, and also in proportion to the sharpness of definition that is required on the plate.

58. **Waterhouse Stops—Iris Diaphragm.** Originally diaphragms were metal plates, each having an opening in the center, of different diameters, ranging in geometrical proportion to the focal length of the lenses to which they belong. They are known as Waterhouse stops, and are inserted in an opening in the lens barrel. The majority of lenses and shutters fitted to the common hand cameras now contain a device known as the Iris Diaphragm, whereby the opening may be decreased or increased in size by the sinble movement of the indicator, B. See Illustrations Nos. 7 and 8. When this lever is turned to any of the figures on the plate at the bottom of the shutter it indicates the proportionate amount of light admitted. The smaller the aperture the greater will be the depth of focus of the lens.

59. **Depth of Focus.** By depth of focus is meant the power which a lens has of rendering a sharp image upon the ground-glass, of objects situated at varying distances. When using the lens at full opening, it is difficult to obtain at one and the same time a clear and sharp image on the ground-glass of both near and distant objects. To obtain this increased sharpness you must make use of the stops or diaphragms. This gives increased depth of focus.

60. **Use of Diaphragms.** The diaphragm markings are usually arranged at the lower part of the front of the shutter. (See Illustrations Nos. 6, 7 and 8.) By using the smaller

EVENTIDE

STUDY NO. 2

BY G. A. BRANDT

opening, *diaphragming down,* or "stopping down," as it is commonly termed, a portion of the rays are cut off and a much greater depth of focus secured; but in employing a smaller opening, cutting out the rays of light, the exposure necessary is greatly increased.

61. There are many defects in some of the cheaper grades of lenses, and, aside from giving a greater depth of focus, the use of a smaller stop corrects different *aberrations* or defects. The more important points to be remembered in using a diaphragm are these:

First, the larger the aperture the more roundness, atmosphere or effect of distance is obtained, the picture presenting a bolder appearance; but a more rapid exposure is required.

Second, the smaller the aperture the longer the exposure, the greater the depth of focus and the sharper the image, accompanied by a corresponding loss in relief. When focusing always have your lens wide open (full diaphragm). After obtaining the focus, stop down only enough to give clear detail in the picture.

62. **To Focus the Camera.** Whatever the type of shutter used, set it at the time exposure and open, using the largest stop or diaphragm. The light will then pass through the lens, permitting you to see the image on the focusing screen or ground-glass. By moving the lens support—*i. e.*, on folding cameras—to and fro on the track, the image on the ground-glass can be brought to a focus, which means clear, sharp definition. With kodaks which are not provided with a ground-glass or focusing screen the focus is obtained by gauging the distance from the camera to the object being photographed, and setting the pointer on

the lens support opposite that distance indicated on the focusing scale.

63. **Regulating Different Openings According to Exposure.** For snap-shot or instantaneous exposures employ the largest diaphragm or opening. In average view work—that is, open landscapes—it is seldom necessary to stop down, *i. e.*, reduce the aperture, smaller than the f/8, or its equivalent U. S. 4. (*See following paragraph.*) The smallest opening should be used only when extreme sharpness of the whole field is required. *For example,* when photographing an interior it will be necessary, in order to secure detail, to have objects close to the camera, in the middle distance, and those more remote, equally sharp.

64. **The Size of the Stops** are numbered in different ways, according to various systems. The two in most use are the "f" and the "U. S." (Uniform System.) The f system refers to the relation of aperature to focal length; while the U. S. is a *uniform* series of markings based on the focal ratio system as shown in the following table, and the aperture numbers give directly the relative exposures. It may be as well to state here, that on shutters of American manufacture the Uniform System of numbering the stops is universally used, while the diaphragms on anastigmat lenses of foreign manufacture are marked according to the f system.

65. The corresponding values are given in the following series:

U. S.	1	2	4	8	16	32	64	128	256
f.....	4	5.6	8	11.3	16	22.6	32	45	64

66. The exposure with a certain stop is one-half of the next smaller and double that of the one next larger; *i. e.*,

if stop f/8 requires an exposure of one second, the next smaller, f/11.3, will need two seconds; while f/5.6, the next larger, will need but one-half second's exposure, and f/4 one-fourth of a second. Or, in the U. S. numbers stop No. 4 requires one second, No. 8 will need two seconds, No. 2 one-half second, and No. 1 one-fourth of a second. The largest opening or the largest working aperture of the lens on the average hand camera is f/8 or U. S. 4. For the beginner, who is apt to become confused by the diaphragm numbers, it is well to remember that the large numbers indicate small openings, and that the smaller the opening the longer the exposure required.

67. **Reversible Back.** All modern high grade folding plate cameras are supplied with a reversible back. This is to enable the user to make either horizontal or vertical views by merely reversing the back attachment without changing the position of the camera. The back is held in place by means of firm clamps, which are easily released when desired. The ground-glass is attached to the frame of the reversible back, so it is always in correct position.

68. **Focusing.** Focusing a camera means the act of bringing the image into focus; *i. e.*, the securing of a clear, sharp outline of the image upon the sensitized plate or film. The focus is secured by moving the lens a certain distance from the ground-glass or focusing screen. This distance depends upon the focal length of the lens employed.

69. **Fixed Focus.**—This term applies chiefly to small box cameras or to those fitted with short focus single lenses. It does not mean any distinct kind of a lens with extraordinary power of covering objects near or far in one plane. The lens is only a fixed focus when it is immovable. While

any lens can, practically speaking, be made a fixed focus, yet its length of focus determines the extent it will focus sharp all objects on one plane. Therefore, those only of very short focus can be used for this purpose, and only small pictures are satisfactorily made with fixed focus cameras. With them, the difference in focus of any object, far or near, is so little that it is not noticeable in the picture. On the larger sizes, however, it would be quite visible. There is no altering of the focus in a fixed focus box camera; the lens in the camera is stationary.

70. **Fixed Focus Folding Camera.**—In the case of the fixed focus bellows camera, the bellows extends to its full length and locks. It is then, practically speaking, a fixed focus camera, the same as a box camera, for there is no adjusting of the bellows. Hence the term, fixed focus folding camera.

71. **Universal Focus.**—The term Universal Focus is quite frequently applied to adjustable focusing cameras. We speak of the Universal Focus when the pointer is set at 100 feet on the focusing scale. All objects beyond this distance are in focus. When, therefore, the bellows of the camera is extended and the indicator points at 100, we speak of setting it at Universal Focus, or point of infinity.

72. **Extending the Bellows for Focusing.**—By turning the lever or pressing the clamp directly beneath the lens at the base of the camera front, you release the lock, and the bellows can be drawn forward on the track or slide provided for this purpose. It is by sliding the bellows backward and forward, bringing the lens closer to or extending farther away from the ground-glass, that the focus is produced.

73. **Scale Focusing.**—Observe on the left side of the camera a scale usually marked No. 6-10-15-25-50-100. These figures indicate the distance the camera should be placed from the object to be photographed. No. 6 would indicate that the camera must be six feet away from the object in order to have it in focus. The pointer being placed at No. 25 would indicate that when the camera is twenty-five feet from the object it would be in focus. It is safe when distances are over 50 feet to set the point of the indicator at 100, as this then becomes, practically, Universal Focus.

74. **Ground-Glass Focusing.**—By focusing is meant, as stated above, the obtaining of good, clear outlines of the image, on the ground-glass, of any object being photographed. This focus is obtained by the racking, or drawing out of the bellows until the image appears perfectly sharp on all parts of the ground-glass. When the camera is used without a tripod, the focusing scale on the side of the camera bed is employed and the pointer is set on the line opposite the figures, indicating the distance between the camera and object, which should give a perfect focus. It is not advisable to alter the camera in any particular until thoroughly familiar with all its parts. To detect any error in the focusing scale, should your pictures be out of focus (i. e., not sharp), study the following instructions and learn how to correct the fault. Again, the proving of the focus is also a very good practice, for one cannot become too well acquainted with his instrument.

75. **Testing the Focus.**—In order to test the focus select a building or object in strong sunlight. Determine the distance this object or building is from the camera, which distance, in order to obtain good drawing, should be suf-

ficient to allow the image not to appear crowded on the finder. Then, set the pointer on the camera to the corresponding number of feet on the scale attached to the camera bed, which should give a sharp focus.

76. After pressing the bulb the first time and opening the shutter, point the camera at the object upon which the sun is shining. Look on the ground-glass and carefully examine the image. If this image appears clear, sharp and distinct, the scale on the side of the camera is correct. If it is indistinct, and the distance from the object has not been misjudged, the scale is incorrect and cannot be relied upon. These scales, however, are usually correct, but in order to test them properly the camera must be placed upon something rigid, *a tripod preferred.*

77. Cover the head and camera with the focusing cloth. With the left hand gather the focusing cloth up under the chin. This will then exclude all light except that which comes through the lens and produces the image on the ground-glass. Look *on* the ground-glass. Do not try to look *through* it. It will take a little practice to enable the beginner to see the image clearly on the ground-glass. The image, of course, will be reversed (upside down). With the right hand reach to the front of the camera and extend the bellows by moving the front section containing the lens. Slide it backward and forward until the image appears perfectly distinct and sharp on the ground-glass.

78. **Correcting the Focusing Scale.**—After securing proper focus, measure the distance from camera to object, and if this distance agrees with the figure indicated on the focusing scale, then the scale is correct. If they do not correspond, the scale can be corrected by focusing on some object

100 feet away. When a correct focus is secured at this given distance, and the actual distance does not register correctly with the pointer on the focusing scale, then remove the plate containing the scale and replace it so that the figure 100 is opposite the pointer. The rest of the scale will then be found to be all right. However, when possible, in order to insure perfect focus, it is advisable to focus on the ground-glass, paying no attention to the scale. When using the camera without a tripod for snap-shot work, it is convenient, of course, to have the scale, and, therefore, it should be correct. As all reputable manufacturers test their instruments very carefully for this particular feature, it will be found that they are, in almost every instance, correct.

79. **Finders.**—Most hand cameras and kodaks are fitted with a little box covered with a metal hood, a lens in the front of it and a small piece of glass on the top. This is called a finder, and is, in effect, a miniature camera. Everything visible on this finder will be visible on the ground-glass, and everything visible on the ground-glass should be visible on the plate when developed. Finders are fitted with fixed focus lenses, and, therefore, the object at any distance will naturally appear sharp on the finder.

80. If it is desired to secure the focus by the scale on the side of the camera, as, for instance, in kodaks, judge carefully the distance to the object to be photographed. With a little practice this can be accomplished successfully. A good plan is to measure by strides, and by pacing off the distance it will then be possible to judge more accurately the right number of feet. The better way, as said before, is to focus on the ground-glass. The finder should only be used when the instrument is employed as a hand camera; i.

e., without the tripod. Thus, the object to be photographed will be located in the finder instead of on the ground-glass. Remember, the finder is only used for locating the object, but not for focusing. The focusing must be done either on the ground-glass or with the scale.

81. **Fixed Focus Box Cameras Require No Focusing.**—The fixed focus or box cameras contain no scale. As they are all a fixed general focus, such cameras need no focusing, and whatever is visible in the finder will appear in focus on the plate or film. But with all other folding cameras containing focusing scale or ground-glass, the focus must be obtained by the above method and not in the finder. Use the finder only for locating the view on the plate. Always remember, first, to locate the view in the finder, for whatever is visible in the finder will be registered on the plate. If the camera is pointed at a building and it looks crowded in the finder, then step back farther from the building until good proportions of margin all around are secured. Judge the distance from the object or building and draw out the bellows until the pointer registers opposite the number of feet which is the distance between the camera and the object. The exposure can now be made.

82. **Rising, Falling and Sliding Front.**—Practically all folding cameras have a rising and falling front, i. e., it is possible to raise and lower the front-board to which the lens is attached. To a certain extent, this feature takes the place of a swing-back or swing-bed. When photographing a building that is not too high and your camera has only the rising and falling front but no swing-back or swing-bed attachment, the camera should remain perfectly level so that the ground-glass will be parallel to the building. To provide more space or sky above the building, or should the building

be so high as to make it difficult to get the top of the building on the plate, raise the front-board, to which the lens is attached. Where the camera is fitted with a swing-bed, as well as with a rising front, both should be employed when photographing extremely high buildings.

83. Many folding cameras have, in addition to the rising and falling front, a sliding front, which is of great advantage when working in confined places. It is possible, by moving the sliding front one way or the other, to secure more or less of either side of a view without altering the position or moving the camera whatsoever; but it is very seldom necessary, in fact it is not so convenient in most cases, to use the sliding front as it is to slightly turn the camera on the tripod head.

84. **Swing-back and Swing-bed.**—While all folding cameras are not supplied with swing-backs nor even swing-beds, many have one or the other of these attachments. The following is a brief description of their use:

The *swing-back* is at the rear of the camera and is so adjusted that it permits the ground-glass to swing perpendicular regardless of the angle at which the camera is tilted.

The *swing-bed* is simply the front or bed of the folding camera containing the track on which the sliding front moves, and the supporting arms or braces which hold this bed in position are so arranged as to make it possible to adjust the bed to any desired angle, thereby enabling you to admit as much sky or exclude as much foreground as desired. In this way the body of the camera can remain in any position at all times, and the ground-glass will always be perpendicular.

85. The swing-back or the swing-bed should be used when photographing extremely high buildings in order to obtain rectilinear lines. When photographing a high building it is necessary to point the lens upward, and if your instrument is fitted with the swing-back this back must be so adjusted as to keep it in a perpendicular position at all times. On the other hand, if your camera has a swing-bed, the camera itself should at all times remain in the same position (i. e., the ground-glass must always be perpendicular), but the swing-bed can be raised and fastened in position, which will give you exactly the same effect as to operate the swing-back (when the whole camera is pointed upward). Whenever the camera is tipped without any change being made in the position of the ground-glass the lower portion of the building will be nearer to the camera than the top, and the nearer an object is to the camera the larger it will appear on the ground-glass and it is, therefore, quite obvious that the lower portion of the building will appear larger and broader than the top. (See Illustration No. 9.) When pointing the camera upward it is necessary to pull the swing-back out at the bottom, which tips the top of the swing-back toward the building, making the ground-glass parallel to the building, or the object being photographed. Of course, when using an instrument equipped with the swing-bed the ground-glass always remains parallel with the building and this difficulty will not be encountered.

86. **Horizontal Swing.**—Most view cameras, and many of the better class hand cameras, are provided, in addition to the perpendicular swing, with a *horizontal* one, the object of this being to bring into focus those objects which are nearer to the camera at one side than those on the other,

as, for instance, a street scene showing the line of buildings on one side of the street which is being photographed at an angle. The buildings nearer to the camera may be brought into sharp focus, in which case those in the distance will be indistinct, and by the horizontal swing these latter can be brought into approximate focus with those nearer to the camera.

87. **Double Swing** is the combination of the horizontal and vertical swings, by which any of the corrections of the image previously mentioned can be made.

88. **Rack and Pinion.**—Most of the higher class folding cameras are supplied with rack and pinion movement, especially those which have a double extension or those with an extremely long bellows. On the side of the bed of the camera is a milled head. By pulling this out and turning it the bellows will be extended. This rack and pinion is, of course, used for accurate focusing.

89. **Tripod.**—The tripod is an accessory employed as a stand or support on which to place the camera while focusing, or making time exposures. The objection to its use, in instantaneous work, is the time it takes to place the camera upon this stand.

The tripod, as its name implies, consists of three legs, each of which can be lengthened or shortened as desired; thus, it is possible to get it into a very compact form. These legs are attached to a head, upon which the camera is fastened by means of a thumb screw. As previously stated, in instantaneous work you can make the exposure by holding the camera in your hand; but for making time exposures you should use the tripod. One of sufficient rigidity should be employed so that when making the exposure the camera

will remain absolutely steady, for the least movement during exposure will cause a blurred image.

When the camera is attached to the tripod, one leg should be under the bed of the camera, pointing toward the object to be photographed. This will leave one leg at each side of the rear of the camera, thus permitting easy focusing, and observation on the ground-glass of exactly what is to be produced by the plate. By this arrangement all of the legs of the tripod will be out of the way.

90. Another advantage in this arrangement is: Should it be desired, while focusing, to raise or lower the front of the camera, this can be easily accomplished by simply bringing the front leg closer or extending it farther from the camera. (See Illustration No. 10, of an adjustable tripod set up for use.)

91. **Plate Holders.**—The plate holder is essentially a part of the plate camera. It is a case or holder, as its name implies, in which the sensitive plate can be carried both before and after the exposure, being fully protected from the light.

92. The plate holders furnished with all modern makes of hand or view cameras have two compartments. In each side it is possible to place one sensitive plate; hence they are termed double plate holders. A slide, fitting in at one end, protects the sensitive surface of the plate from being exposed to the light. The plate holders should be loaded with the sensitive plates, and the slides placed in position, in the dark-room. You should have at least three plate holders with a camera. Load as many holders as desired. To make the exposure the holder is inserted in front of the

Inserting the Slide

Illustration No. 11
The right way
See Paragraph No. 93

Illustration No. 12
The wrong way
See Paragraph No. 93

Illustration No. 9
Result of tipping camera without proper adjustment of swing back.
See Paragraph No. 85

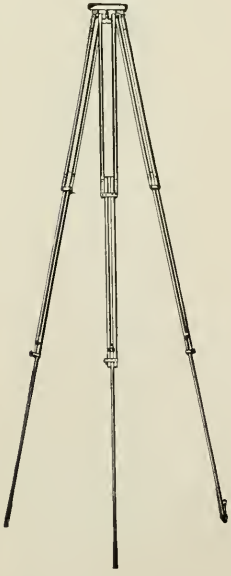


Illustration No. 10
Adjustable Tripod
See Paragraph No. 90

Illustration 13
Dark Room Lamp
See Paragraph No. 99

Illustration No. 14
Roll of Film

Illustration No. 15
A Temporary Dark Room
See Paragraph No. 98

ground-glass (an aperture for the plate holder being found at the side of the camera). In most cases there are heavy springs which keep the ground-glass in place. When the plate holder is inserted the ground-glass is forced back, and the spring serves to hold the plate holder flush to the camera.

93. **Inserting Slide in Plate Holder.**—You will notice that the handle or top part of the slide, which covers the plate in the holder, is painted a light color on one side, while the other side is black. When you load your holder, have the light side of the slide facing out. After you have made the exposure return the slide to its proper position, with the black side out; in other words, the black side should face the front of the camera after the exposure is made, indicating that the plate on that side of the holder is exposed. (See Illustrations No. 11 and No. 12 for the right and wrong way of inserting the slide in the slot of the holder.) Always push the slide in straight, and never one corner first, as that is apt to fog the plate.

94. By carefully following these directions no trouble will be experienced in keeping track of the exposure—i. e., knowing exactly which plates have been exposed and which have not.

95. **Dark-Room.**—A room of some kind, in which to undertake all the operations of loading the plate holders, removing the exposed plates from the holders, developing the plates, etc., is necessary, except where the daylight loading films are used and the development is done in the now universally used film tank. This room is commonly termed a dark-room, and must be absolutely free from all white light or light of any kind that may act on the dry plate. To insure the room being perfectly dark, it is always a wise

plan to wait two or three minutes in the room, after the door has beeen closed, until the eye has become accustomed to the darkness. Rays of light which were not then perceptible will make themselves apparent, and these should be carefully blocked out with cloth, felt or heavy black paper. The only light that can be used in the dark-room during the handling of the sensitive plate, from the loading of the holder until after the fixing of the plate, is the ruby light, which is non-actinic—i. e., has no chemical action on the sensitive plate.

96. A closet or the bath-room, or any other room, can, of course, be used for a dark-room, providing every possible avenue where light may enter can be closed. If it is not convenient to have a dark-room of this kind, load the holders and develop the plates at night, in a room from which every ray of white or actinic light has been excluded.

97. In the dark-room, aside from the ruby lamp, there should be a perfectly dry shelf, on which to load and unload the plate holders and keep the plates. There should be another shelf or small table, on which to develop, where the developing solutions, trays, etc., should be kept. If possible, a sink and running water should also be in the dark-room. If, however, these are wanting, a large basin or tray can be employed and provision made for one or two pails of water. Procure a large wooden pail and place a small faucet near the bottom. In this pail place clear water to use in mixing the chemicals and in rinsing the plates. Have another pail in which to pour the waste water, old developer, etc.

98. Shelves on the wall, on which to place various stock solutions, trays, graduates, etc., will be found very convenient. (See Illustration No. 15 of a temporarily ar-

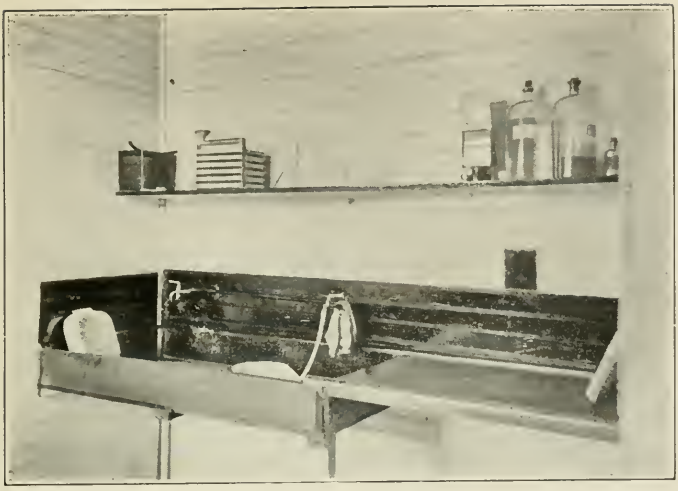


Illustration No. 16
An Inexpensive Dark Room Sink
See Paragraph No. 98

Illustration No. 17
Loading Plate Holder
See Paragraph No. 103

ranged Dark-Room, being a corner of a bath-room. Also No. 16, a cheaply constructed Dark-room, Sink, Shelves, etc.)

Note—Detailed descriptions of conveniently constructed dark-rooms are given in Chapter XXXI.

99. **Ruby Light.**—As the dry plate on which the image is to be photographed is extremely sensitive to all white light, only non-actinic light—i. e., light that has no appreciable effect on the plate—can be employed in handling it. Such light should be of a ruby color, or reddish yellow, and is usually obtained from what is called a dark-room lamp. There are many kinds of good dark-room lamps, arranged to burn oil, candles, gas, incandescent light, etc., and these are fitted with glass specially colored to give the correct kind of light for handling the plate. A lamp burning kerosene, or fitted with a bulb for an incandescent lamp, is the most satisfactory to use, candle lamps not being so satisfactory. (See Illustration No. 13, of an inexpensive dark-room lamp.)

100. **Developing Outfits.**—A few essential pieces of paraphernalia which every amateur should possess for the development of the exposed plate, are a good ruby lamp, four or five trays, to fit the size of plates or films used—one tray to be used *only* for developing, another for fixing *only*, the other two or three trays for washing and after manipulation; one graduate, about 8 ounces in size, one stirring rod, and a camel's hair brush.

101. The essential chemicals for the beginner are the developing powders and hyposulphite of soda for fixing. Later when preparing the solutions from the separate ingredients, it will be necessary to have the required chemicals.

102. **Opening of Box of Plates.**—Plates of American manufacture are packed back to back in boxes of one dozen each, the faces being slightly separated by a small piece of cardboard, and are protected from the light by a double cover. To open the box, run a knife blade along the under edge and cut between the two layers of cardboard which form the two covers. This operation can be done in the white light, but neither cover should be removed outside of the dark-room. Before removing the covers of the box of plates the ruby lamp should be lighted, as it is necessary to have illumination of some kind by which to work. Previous to closing the door, remove the slides from the plate holders and carefully dust both the slides and the interior of the holders.

103. **Loading the Holders.**—When ready to load the holders, having entered the dark-room and closed the door, remove the covers from the box of plates and turn back the black paper in which they are wrapped. The top plate will be face or film side down. Pick this plate up by the edge, being extremely careful not to touch either surface. At the lower end of the holder is a spring. Place the edge of the sensitive plate, with the film side out, against the spring, and press down on the spring until the plate drops into place. In some plate holders the spring holding the plate in place is controlled by a little metal lever on the outside or edge of the holder. By pulling down on the lever on the right hand side, it presses down the spring and the plate falls into place. After the plate is in place, press the lever back into position, when the plate is secured. (See Illustration No. 17—loading the ordinary holder.)

104. After loading one side of a plate holder, carefully

draw the camel's hair brush over the surface of the plate, to remove any dust which may have accumulated on its surface. With the light colored side facing out, insert the slide in the slot at the end of the holder, thus covering the sensitive plate. Proceed in like manner to load the other side of the holder, as well as the remaining holders. The second plate in the box will be face or film side up, the third plate film down, etc. Carefully replace the covers in proper order on the box of plates, after all holders are loaded. Then the door of the dark-room may be opened and the ruby light extinguished.

CHAPTER III.

How to Proceed.

105. The first and most important consideration in all good picture making is the angle of light. By comparing the lens and camera with the human eye, one can have a fair idea of the effect of light upon the sensitized plate. For instance, when viewing a building with the sun in front of you, shining toward you, the effect of light is very blinding to the eye, and the object or building appears dim and hazy in its shadows. This same effect is produced on the sensitized plate in the camera, by the light entering through the lens. In other words, in order to obtain clear results the camera should never be pointed toward the sun. Therefore, the beginner should exercise care that the sun is to one side, or even behind the camera.

106. The beginner can produce good, clear pictures by having the sun fall full on the side and the front of a building, for then the shadows are so small and few that he is sure of securing a strong picture; yet this is not always necessary. Lights and shadows that are clearly visible to the eye, and do not affect or weaken it, will have the same action on the sensitized plate through the lens, and the different degrees of light and shadow on the object or building will be reproduced on the plate.

107. Dark buildings, such as those of red brick or very dark painted houses, should be photographed with the

sun shining on the side and front of the building. Were such a building photographed on the shadow side, the dark color, with little or no high-lights would produce a very dull, flat picture, while with a very light color building it is entirely permissible to photograph from the shadow side, for the entire building being light in color the shadows will be sufficiently illuminated. The sun shining on the front, throwing shadows from projections, cornices, etc., would give the required snap and contrast to the entire picture.

108. On the other hand, if this light colored building were photographed with the sun falling on both side and front, there would be little contrast and the artistic effect would be lost, yet from a commercial standpoint it would still be a good picture. If the building were a factory, or a large store, then full sunlight on the front of the building might be necessary; but when photographing residences, the prettiest effects are produced when more shadows are visible, producing greater effects of contrast.

109. A thorough understanding of the two preceding paragraphs will show the beginner that the effects of light and shadow, as shown on the ground-glass, should be carefully studied, as the results shown on this ground-glass will be reproduced upon the sensitive plate when a proper exposure is made. Careful observation should be made of the appearance of different objects and buildings, trees, shrubbery, fences, etc., with the sun shining upon them at different hours of the day. Frequently, in walking along a street the beautiful appearance of a residence may be observed when the sun falls upon it, with little shadows thrown from the cornices and trimmings, giving them a boldness and an effectiveness which are entirely lacking when the same

Illustration No. 18
Light Building Properly Photographed
See Paragraph No. 109

Illustration No. 19
Dark Building Improperly Photographed
See Paragraph No. 109

Illustration No. 20
Effect of Proper Angle of Light
See Paragraph No. 111

Illustration No. 21
Illustrating the Effect of Blistering
See Paragraph No. 129

building is viewed from a different point, or at another hour of the day, when it may appear very dull and flat. It follows from this that photographs should be made at that time of the day when the sun supplies the most shadows to the object or residence you are photographing. See Illustrations Nos. 18 and 19 of a building photographed under both conditions.

110. To demonstrate more clearly the effect produced by light and shadow take your camera, attach it to your tripod, and view on the ground-glass the object or building from the side upon which the sun is shining; then transfer the camera to the opposite or shadow side and note the difference in illumination. If your camera is not fitted with a ground-glass these same effects may be observed in the view finder.

111. You should now be prepared to make an exposure. Select any building or object you may desire. As said previously never point the lens of the camera toward the sun, but have the sun falling from the rear or on one side of the camera. (See Illustration No. 20.) Should the rays of sunlight strike into the lens they throw a reflection from the sides of the lens barrel, causing a fog or blurred appearance upon the ground-glass and plate, and the resulting image will be anything but satisfactory.

112. Carefully focus on the ground-glass of the camera, using full aperture. See that all perpendicular lines of the building are parallel to the sides of the ground-glass. The raising or lowering of the lens will assist you in getting the building properly located on the ground-glass.

Note—The beginner who is working with a box or similar form of folding camera, provided only with a single lens, should

understand that it is practically impossible to photograph buildings and obtain the straight lines of the building, or other objects, accurately produced on his plate or film. As mentioned under the heading of lenses, in the preceding chapter, to obtain straight lines at the edges of your plate it is necessary to work with a doublet instead of a single lens.

113. After securing a sharp focus, stop the lens down to about U. S. 4, or to its equivalent, f/8. Now close the shutter and insert the plate holder in the opening at the side of the camera just in front of the ground-glass. *Be sure that the projection or groove near the end of the holder fits snugly into the groove or projection on the back of the camera.* The plate holder should *fit perfectly flush,* so that no light can enter between plate holder and camera to fog the plate.

114. Being absolutely sure that the shutter is closed and set (in this case at 1-25 of a second, or if your shutter is not fitted with the various degrees of speed, make an instantaneous exposure, the lever being placed on I), then withdraw the slide nearest the lens and press the finger release or bulb *once,* thus making the exposure. After the exposure is made, replace the slide in the holder, being sure that the black side of the handle is facing outward or towards the lens. This signifies that the plate in this side of the holder has been exposed.

115. For the value of the experience and the practice derived it is advisable to make two exposures; therefore, withdraw the plate holder and, reversing it, insert again in the camera, and after setting the shutter withdraw the slide of the unexposed plate. Make another exposure of identically the same subject, giving the same time (1-25 of a second). If the beginner is working with a film camera he will, of course, have observed his picture on the view finder

and focused by means of the focusing scale, having paced off the distance from the camera to the object, if uncertain as to his ability to correctly gauge the distance. When the first exposure has been made wind up the spool of film to the next exposure, and make a second exposure as just described. Then proceed to some other object and make two more pictures of that, using the same length of exposure. If a double two film is used this will use up the entire roll, so that it can then be developed. Then return to the dark-room and proceed to develop one of the negatives. After developing, fixing, washing and drying this plate or film make a proof print from the negative, using a printing-out paper. Note the results. Is it clean, clear, sharp, brilliant, and above all has it pluck and roundness? If not, study your instruction for developing, and observe wherein you failed to produce these results and apply the experience gained on the development of the first plate to the second one and proceed to develop it and endeavor to overcome your first errors. Make a memorandum on the back of each proof print of your methods of procedure, and file this proof in your letter file (proof book) for further reference. For development of the films singly, see Chapter V.

116. **Developing Solutions.**—The use of prepared developing powders is recommended to the beginner for his experiments in developing plates or films. These powders can be procured from any dealer in photographic supplies. If a regulation finishing outfit has been purchased the chemicals included therein can be used. Prepared developing chemicals only require dissolving in a certain quantity of water, the directions for which are always given on the package.

117. In the graduate, which has been thoroughly cleansed, place the amount of water specified in the directions. The developing powders come, generally, in two small packages, these again being put up in one larger package, or, the powders are inserted in both ends of a glass vial, separated by a cork or wad. Carefully open the larger of the two packages, or remove the cork from that end of the vial containing the larger quantity of chemical, and slowly shake the contents into the water in the graduate, stirring rapidly until all is thoroughly dissolved. This chemical, which is generally the sulphite and carbonate of soda, if not made to dissolve immediately by rapid stirring will cake and cause considerable trouble, being left in the solution in the form of a precipitate. When thoroughly dissolved add the contents of the smaller package, or the smaller quantity of chemical in the vial, which is the developing agent. The developer is now ready for use.

118. **Fixing Solution.**—After mixing your developer, next prepare the fixing solution. Take a handful of hypo and place in the 4x5 tray which you intend to use for hypo *only,* and fill this tray about two-thirds full of water. This should give a proportion, approximately, of one ounce of hypo to four ounces of water. Stir this with a small wooden paddle, or glass stirring-rod, until all of the hypo has been dissolved. Under no conditions use this tray for any other purpose than for fixing. Always wash the hands thoroughly after handling any chemical. Hypo, especially, will give no end of trouble if the least trace of it is carried to any other bath.

119. **Development.**—Everything is now in readiness so that development of the exposed plate may be proceeded

with. With the developing tray carefully rinsed and the ruby lamp lighted, now close the door of the dark-room, so that there is absolutely no other light in the room except that which comes from the ruby lamp. Draw the slide from the plate holder and remove one plate. Sometimes the plates are liable to stick in the plate holder. By pushing down with the thumb on the small spring at the end of the holder, gently tapping the holder on the other end, and slightly tipping forward, the plate will fall into your hand.

120. As soon as the plate has been exposed an image has been formed, although invisible until acted upon by the developer.

121. After removing the plate from the holder, place it in the tray for developing, being sure that you have the face or film side up. Pour sufficient developer over the plate to cover it, and in doing so, care should be taken that the developer is flowed evenly over the entire surface of the plate, to drive off all the air and not allow any air-bells to form. If the developer is carelessly thrown onto the plate, or if the plate is dropped into the developer, small air-bells are liable to form on the surface of the film, which will prevent the action of the developer on the portion of the film which they cover and thus cause undeveloped spots. The plate should never be placed in water before development. In the case of films, however, it is preferable to wet them in water before placing them in the developer.

122. Always use enough developer to fully cover the plate. Four ounces of solution are sufficient for a 4x5 tray. After flowing the developer over the plate, the tray must be rocked gently, and the development carefully watched. In from 20 to 30 seconds the image will begin to appear. If

the developer is cold, the image will be much slower in making its appearance; yet it is advisable that the temperature should not be over 65 deg. Fahr. The image will gradually grow denser, as development proceeds, until finally the plate is nearly black. At this stage it should be carefully examined, to observe the strength of the development.

123. **Definition of a Negative.**—The action that is taking place on the plate during development is as follows: The light that passes through the lens affects the plate in proportion to the strength of the rays from the object; consequently, the rays of light from the shadow parts of the object will have less action on the plate than the rays of light from the lighter parts. During development, the parts of the plate most affected by the light appear first, and will grow darker as development proceeds, while the parts affected by the shadow rays will show but slight discoloration on the plate. This is why the plate is called a negative, because it gives the lights and shadows in reverse order to what is actually seen in the object.

124. **Judging Development.** — Carefully remove the plate—handling it by the edges only—from the tray and hold it up to the ruby light, *looking through* it. If the highest points of light, or more clearly speaking, the blackest parts of the image, are extremely dense, so that you can scarcely see through them, then the development has been carried far enough. When those parts of the sensitive film on the plate—emulsion—which have been affected most by the light have been reduced completely to metallic silver, through the process of development, it is impossible to carry them any further. Continued development will

simply reduce the more delicate tones, making them as dense as the highest points of light, thus causing what is usually termed a spreading of light, and when a print is made from such a negative the high-lights are hard and chalky, instead of being soft and mellow.

125. **Fixing.**—After development, the plate should be thoroughly rinsed in clear water; then place it in the hypo fixing bath, film side up, where it should remain until the unexposed and undeveloped silver salts have been removed. In other words, all the white that appears on the plate, as seen when looking at the back of it, must be cleared away. A negative should not be examined, except by ruby light, until it is thoroughly fixed. This may require ten minutes, or longer, and in order to assure thorough fixing the negative should remain in this bath double the length of time necessary to remove the white effect, or unexposed silver salts. After the plate is fixed, place it in another tray for washing (if you have no washing box) and allow the water from the faucet to run into the tray gently, so as not to strike the face of the negative. An ordinary pail or basin may be used, if a tray or washing-box is not available. Washing should be continued for at least twenty minutes, and then the negative should be placed on a rack or stood up against the wall to dry.

126. **Drying.**—Negatives should be dried in a well ventilated room. If the room is too warm, the film is apt to become soft and the negative will be ruined. Never dry the negative in the sun or near the stove.

127. This instruction is only a primary one, dealing with prepared chemicals, and has been made as simple as

possible, giving no reasons, as these features will be fully explained in succeeding instruction.

128. Proof prints should be made of your experiments of this instruction, and all data pertaining to the results secured or failures met with noted on the back of each individual proof. Each of these should then be numbered and dated in the order made, and filed for future reference in your letter file or proof book.

Defective Negatives and Their Cause.

129. Illustration No. 21 shows a case of blistering, caused by a difference in the temperature between the developer and the wash water. Blistering is also caused by the wash water, as it comes from the faucet, containing a considerable amount of air, which being forced under the film, raised it on the spots shown. The solutions and wash waters must always be kept at a uniform temperature, and the water coming from a faucet must not be allowed to *drive* on the plate. Should the water contain a considerable amount of air, as is the case where water is pumped into the mains, or sometimes when breaks in the water mains have been repaired and the water again turned on, forcing air into the pipes, this air or gas may affect the film. Under such conditions it would be far better to wash the plates in a tray, changing the water at least ten times during a period of one hour. The water used should have been drawn from the faucet and allowed to stand for five minutes before placing it in contact with the plate.

Illustration No. 22
Showing the Result of Fogging the Plate
See Paragraph No. 130

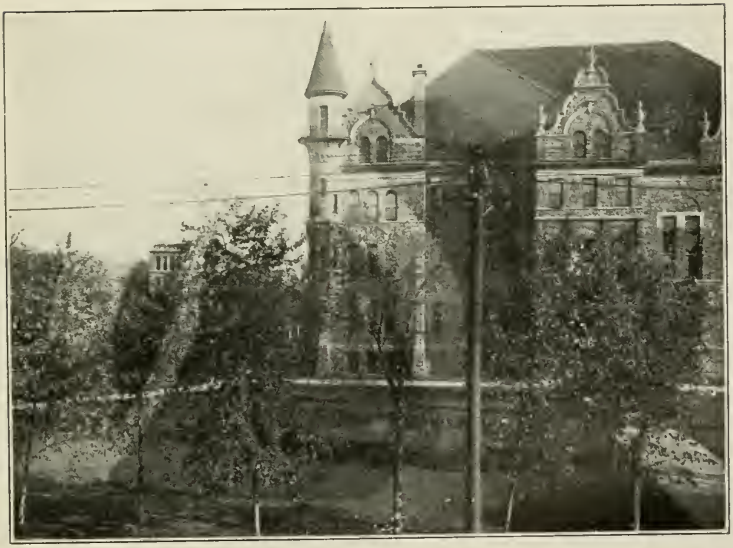


Illustration No. 23
Showing the Results of Uneven Development
See Paragraph No. 131

130. Illustration 22 shows the result of fog when the plate holder is not properly inserted in the camera. It is absolutely essential that the holder be pushed in far enough so that the rib or groove on the camera fits snugly into the groove or rib of the plate holder. If they do not fit properly, fog will invariably be the result. This fog occurs in different forms, but the one illustrated herewith is quite common. Frequently when the plate holder is not properly inserted in the back of the camera the top and bottom of the plate will also be fogged. Improperly inserting the slide in the holder will cause a similar fog. The slide must never be inserted one corner first; always push it in straight, i. e., the end of the slide must enter the slot evenly. (See Illustration No. 11).

131. Illustration 23 contains numerous defects, but the one which comes to our attention most strongly is the uneven development shown by the large, light streaks, which were caused by flowing the developer over only a portion of the plate in place of covering it entirely. It is absolutely necessary that the developer be flowed evenly and uniformally over the whole surface of the plate at once, for if this is not done, streaks and spots will result.

CHAPTER IV.

BEGINNERS' DIFFICULTIES.

132. **Unable to See Image in the Finder.**—You have probably looked into the finder at the wrong angle; the camera was pointed toward the sun; or direct sunlight fell on the top of the finder. Almost all finders have a little hood that must be raised to shield it from the strong sunlight. You will be able to see in the finder a clear image of the object in front of the camera by shading the top of the finder with your hand (care must be taken that your hand does not cover the little lens in the front of the finder) and looking straight down on the finder. If you are pointing your camera away from the sun there is very little danger of the sun striking the finder, and you will have no trouble in seeing the image.

133. **Unable to See Image on the Ground-Glass.**—You have not excluded enough white light with the focusing cloth; the focusing cloth may be too thin; perhaps you have not opened the shutter so that the light can enter the camera; the diaphragm in the shutter may be at the smallest opening, thus not admitting very much light. Do not look **through** the ground-glass. To view the image on the ground-glass be sure that the lens is wide open (using the largest "stop" or diaphragm) and allow no light to strike the ground-glass with the exception of that which comes through the lens. If you use a small stop the image will be much more indistinct on the ground-glass. Do not try to look through the ground-glass, but look on it, as though you were looking at a mounted picture. A little practice will readily overcome any difficulty you may experience at first in locating the image on the ground-glass.

134. **Cannot Secure a Sharp Image.**—If the image is not sharp, the difficulty lies in not having the lens at the correct distance from the ground-glass (dry plate or film). If your camera has a

ground-glass, proceed to focus as previously instructed, and rack the bellows backward and forward until the image is sharp, then lock the lens support in position.

135. **Image Not Sharp When the Camera Is Used as a Hand Camera and Set at the Correct Distance Indicated by the Scale.**—If the pointer registers at the proper figure on the scale indicator, and the image secured on the developed negative is indistinct—blurred—the trouble lies in the scale of distance not being in proper location. For method of corrections see paragraphs Nos. 75 to 78 of this instruction, which fully explain how to proceed to correct the position of the scale.

136. **Distortion of Perpendicular Lines of the Picture.**—In taking a picture of a building, and especially when the sides of the structure come near the edges of the negative, a distortion often occurs—the outside walls of the building being in the shape of a pyramid. This is caused from tilting the camera upward, which brings the lower part of the ground-glass or plate nearer to the building than the top of the ground-glass or plate. To avoid distortion of perpendicular lines of a building, the ground-glass or sensitive plate must always be absolutely parallel with the building or perpendicular to the ground. If possible, and especially where the building photographed is very tall, it is advisable to both raise the lens and use the swing-back or swing-bed. This same difficulty will appear should you point the camera down, although the pyramid effect will be reversed and the method of handling and correcting the distortion correspondingly regulated.

137. **Image Very Dim and Hazy on Ground-Glass.**—(a) Caused by pointing the camera toward the sun and allowing the sunlight to either come into the lens direct or to fall on the edge of the lens tube and reflect into the lens. The lens is the eye of the camera, and is affected in a similar manner to the human eye in this respect—everything appears hazy and dim when looking toward the sun.

(b) In midwinter, taking the lens from a warm room into the cold causes moisture to gather on the lens and also on the ground-glass, thus hindering the rays of light from producing a

clear image. All doublet lenses, and especially those which are mounted very close together (the rectilinear and anastigmat types) are extremely sensitive to temperature. When the moisture gathers and dries it leaves a slight scum, which is very much similar to that formed on windows which have been steamed. This scum will, in time, affect the working of the lens, producing hazy effects. A very SOFT cloth should be used to wipe off the lens, but the greatest of care must be exercised not to scratch it. The fingers should never be placed in contact with the lens. Only in extreme cases of necessity should the lens combination be taken apart. This can be done when you consider it advisable, but be sure to return each individual lens to its proper cell. If after breathing on the lens and wiping it with the soft cloth, you are unable to remove the scummy appearance, moisten the cloth with alcohol and apply it lightly, then wipe dry with another portion of the same cloth.

138. **Extreme Distance Not Sharp.**—The hazy appearance of the extreme distance on the ground-glass is caused by the lens not having been set at the point of universal focus, or point of infinity as it is sometimes called. (See Paragraph 71.) The remedy is either to set the lens on the 100 foot mark on the scale, or to rack the bellows in until the image appears sharp. Greater depth, i. e., greater clearness or sharpness of the image, between a certain near and distant point, can be obtained by stopping down the lens, remembering always that the more you stop down the sharper will be the picture, the greater the depth, but also the longer the exposure that will be required.

139. **Foreground Not Sharp.**—If you are photographing a view or scene that has objects in it situated at varying distances—say from 10 to over 100 ft., and having first secured a sharp focus of the object at 50 ft., thus dividing the focus of the two extremes, you will still find that the objects nearer to you than 50 ft. and 100 ft. away are not sharp enough, these can be made sharper by stopping down the lens. If you do not care anything about the objects in the distance, and the objects in the foreground are the important ones, you should focus on the most important object or objects and then stop down the lens only enough to give you as much sharpness

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as you desire in the distance. A strong effect of atmosphere or distance, which is very artistic, is secured by allowing the distance to remain slightly diffused, or out of focus.

140. **Obtaining Sufficient Angle of View in Narrow Streets.**—If the street is a narrow one and you are using a rectilinear lens—the majority of view outfits are fitted with these lenses—it will be impossible to overcome this difficulty. You can, however, procure a lens attachment for shortening the focus of the lens and give a wider angle, or you can purchase a regular wide-angle lens. By placing the attachment on your regular lens the size of the image will be reduced and the view can be obtained on the plate without any crowding.

141. **Too Much Foreground.**—This is usually caused by the camera being tilted downward in place of being level. If the camera is level, and yet too much foreground is seen, this difficulty can be readily overcome by the use of the rising front to which the lens is attached. By raising it you will obtain more sky. If the camera does not possess the rising front, extend the whole tripod and draw the legs closer together thus raising the camera.

142. **Too Much Sky.**—Camera pointed up too much. By dropping the rising front more foreground can be secured, hence less sky; or the whole tripod can be lowered if the camera does not possess the rising and falling front.

143. **Plates Sticking in the Holder.**—This will happen sometimes when using new plate holders, or if the plate is a little large or made of thick glass. The latter trouble will not be experienced if high grade plates are used, as reliable plates are coated on specially prepared glass which is very thin. By pushing down the spring on which the plate rests and tapping the plate holder gently on the back, the plate will generally fall out. Tapping the end of the holder, containing the spring, on your hand or the edge of the table—at the same time tilting the open side of the holder forward—will cause the plate to drop out into your hand. Practice this latter method—outside of the dark-room—with an old plate, until you understand and can accomplish the removal of the plate with ease.

144. **Unable to Tell Which Is the Film Side of the Plate.**—Plates of American manufacture are always packed face to face, the top one being face down. The face or film side has a dull appearance when viewed by reflected light, while the back or glass side is glossy. Dampen your finger and place it on the extreme corner of the plate—the sticky side is the film side. CAUTION—Never touch either side of the plate; always handle it by the edges.

145. **Distinguishing Exposed and Unexposed Plates When Mixed.**—There might be a time when you happen to place exposed and unexposed plates together, or you might fail to turn the slides properly after making the exposure, and thus be in doubt as to which of the plates have been used. Exposed and unexposed plates have the same appearance to the eye before development. In order to avoid spoiling all plates by developing them in trying to ascertain which have been exposed, dip your finger in the prepared developing solution and apply it to the corner of the plate. If within a minute's time there should be no darkening of this portion, try another plate in the same way. The plates affected by the developer are, of course, the ones exposed, and you can proceed to develop them as usual, replacing, for further use, those not affected. Judicious application of the developer to the corner of the plate will not spoil the plate—at least, this method is a much better one to follow than to develop all plates in order to find the right one and lose the unexposed plates altogether.

146. **Weak Ruby Light.**—Even with the ruby lamp lighted, when you first enter the dark-room difficulty will be experienced in seeing, and you might think that you have not enough light. It requires very little light to work by, but your eyes must first become accustomed to it. Before you start to develop, close your dark-room door and remain for a few minutes until you become accustomed to the semi-darkness. When you are ready to examine your plate, hold it up close to your ruby light and look through it. After a little experience you can work intelligently with the dim light. Care should be taken in using an oil lamp, that the flame is not too high, as it will smoke, causing unnecessary heat and odor. Remember, the strongest attribute of the dry plate is that it is

affected by light; therefore, it MUST be handled in the least amount of light possible.

147. **Chemicals Will Not Dissolve.**—The powders, perhaps, have not been mixed with the water in proper order, or the water is too cold. Always dissolve the sodas first—the largest package, or the larger of the two amounts of chemicals in the tubes. The developing agent dissolves very readily, but you should stir the water rapidly while adding it. In adding the soda, do not pour in too much at one time, as it will cake and become hard, when it is almost impossible to dissolve it. Warm water will break up the crystalline formation much more readily than cold water, and will also hold in solution a greater quantity of the chemical.

148. **No Image Appears Upon Continued Development.**—The plate is badly under-exposed or not exposed at all. In the latter case you may have forgotten to draw the slide, or your shutter did not work. Possibly the shutter was not set, if it is one that needs setting at each exposure. While making the exposure the focusing cloth may have hung over the lens.

149. **Image Flashes Up and Quickly Darkens When Flowed With Developer.**—If the plate becomes black when covered with the developer it has been extremely over-exposed, either by the shutter not closing properly, or white light, other than that which came through the lens at the time of exposure, has affected it. In other words the plate has been fogged. If the edges of the plate protected from the light by the edges of the plate holder do not become dark, the trouble is over-exposure. If the plate holder was not placed in the back of the camera properly, the plate could have fogged and the edges of it still remain clear upon development. Or, if the shutter on your lens is loose, especially on box or film cameras, and you happen to hold the camera (even if you are not making an exposure) so that the sun strikes the lens, the light is admitted and causes a fog. To avoid any possibility of fog, the greatest care should be exercised at every stage in the handling of the plate. Be sure that your ruby lamp is perfectly safe. See that no white light enters into the dark-room from any source whatsoever. In placing the plate holder in the camera, see that it is per-

fectly flush with the back of the camera. (See paragraph No. 92.) Make a record of every exposure, and if the plate develops up quickly and becomes very dark almost immediately—the edges of the plate remaining clear—the exposure for that particular plate was too much.

150. **When to Stop Development.**—It requires considerable practice to become expert in judging when a negative is correctly developed. Negatives of various kinds of lightings require different treatment, yet, there is one principle that holds good in all cases. The development must be carried until the highest point of light (the darkest point in the negative) is perfectly opaque (black in the negative). It must not be carried further, as the delicate half-tones, almost as strong as the highest point of light, will then develop down and become just as dense as the high-light—causing a flat, chalky effect in the finished print. The highest point of light must be developed until every particle of silver has been reduced—using a photographic term "Develop until the highest point of light is through to the glass, but stop there, as you cannot drive it into the glass."

151. **Judging Density.**—Fixing the plate reduces its density to quite an extent—the amount depending on the thickness of the emulsion, which varies in different makes and brands of plates. There are numerous methods employed by photographers to judge density. We recommend the beginner to hold the plate before the ruby light and place one finger close to the film near the strongest high-light. When this highest light in the negative is as dense as the shadow cast by the finger, you can consider the plate developed to the proper strength. When you think development has been carried far enough try to fix in your mind how the plate appears; notice especially the density and its comparison with the deepest shadows. After "fixing," examine the negative in daylight, by looking through it. If the highest point of light is practically opaque, the development has been correct. If the high-light is thin, the negative is under-developed, while if the high-light is dense and covers quite a little space, it is over-developed. Make a close study of each negative and govern yourself accordingly in developing the

next plate. By this practice you will soon learn to secure proper density in your negatives under all conditions.

152. **Pin-Holes and Spots.**—There are endless ways in which pin-holes and spots are produced on the negative. The best way to avoid trouble from this source is to be clean in all operations. Your dark-room, graduates and trays should be kept clean. Your camera and plate holders should be dusted occasionally. The fixing solution should be filtered, after considerable use, to free it from any sediment. Each plate must be carefully dusted before placing it in the holder and before development. The small round spots which are nearly transparent and have dark, defined edges are caused by air-bells adhering to the surface of the plate when the developing solution is first applied, the air-bells preventing the developing solution from acting upon the emulsion. Having the developer in the tray and dropping the exposed plate into the developer, without sufficiently agitating the solution, will almost always cause air-bells and leave the small transparent spots. Have the developing solution in a graduate and place the exposed plate in a dry tray, then flow the plate with an even sweep of developer from the graduate. This method of application will drive off all air from the plate and allow of an even and uniform action of the developer. Air-bells can also be removed by gently passing a tuft of absorbent cotton, thoroughly saturated with developer, over the surface of the plate immediately after the plate is flowed with the developer.

153. **Judging When a Plate Is Fixed.**—A plate is not "fixed" until the white, milky appearance disappears from the back and the plate has remained in the hypo bath as long again as it has taken to remove the white effect. Under proper condition, a plate should remain in a correctly prepared bath for at least fifteen minutes, or even an hour will do no harm. But if left in an old bath, at a moderately high temperature, too long, the image on the negative will be reduced.

154. **Edges of Negative Fogged.**—If, after development, the extreme edges of the negative are dark and fogged, the plates are old. Buy only plates that are guaranteed to be fresh, and use the

best brands only. The slight additional cost is made up in the saving of wasted material and in securing satisfactory results.

155. **End or Corner of Negative Fogged.**—If dark, angular streaks cross the negative from the end, the slide of the holder was not removed or not inserted properly. (See paragraph No. 93, also, Illustrations No. 11 and No. 12.) Should fog appear at the corners of the negative the trouble is with the box containing the plates. If carelessly handled the corners of the box will break open enough to admit a little white light, resulting in fog and light streaks across the corner of the developed negative.

156. **Shadows Fogged.**—The negative has been over-exposed. Use less exposure in making future negatives under same conditions.

157. **Large Light Spots and Streaks on Negative.**—These are caused by one of two things: either the plate was not evenly covered with the developer when it was first poured on, or the plate was placed in the tray face (film side) down. The parts of the plate that do not come in contact with the developer when first poured on will not develop up as strong as the balance of the negative, no matter how long you leave the plate in the solution—uneven development is sure to show. Insufficient amount of solution will also cause uneven development. (See paragraph 131, and Illustration No. 23.)

158. **Large Black Spot in Center of Plate.**—Pointing the lens of the camera toward the sun will, in most cases, cause reflection, resulting in a bright spot in the center of the ground-glass and producing a black spot on the center of the negative. The higher types of lenses will not produce this spot to any great extent. When it does occur it is due to a defect in the lens, termed "flare." For beginners it is always best to follow the rule, "Never point the camera toward the sun," no matter what kind of a lens you are using.

159. **Back of Negative White When Removed from Fixing Bath.**—Plate was removed from the fixing bath too soon, not being allowed enough time for the removal of the unacted-upon silver salts. The milky appearance must be entirely removed. For proper

fixing, however, the negative should remain in the hypo bath just twice as long as is necessary for the white appearance to disappear. Thus, if the white effect is entirely removed in ten minutes the negative should remain in the fixing bath for twenty minutes.

160. **Negative Will Not Fix.**—Caused by a hypo bath being extremely weak or too cold. A weak hypo bath, of course, is not strong enough to act upon the unused silver salts in the negative; while too cold a bath not being able to hold a great quantity of chemicals in solution, will not fix the negative, because in fixing it is necessary to dissolve the unused silver out of the emulsion and it is obviously necessary that there should be room in the hypo bath to hold this silver. One ounce of crystal hypo to four ounces of water is the correct proportion for the PLAIN hypo bath. The hydrometer test for making a PLAIN hypo bath is 70 degrees. Follow the formula in making the ACID hypo bath.

161. **Fixing Bath Discolors After Slight Use.**—This is due to your failure to rinse the negative carefully after removing it from the developing solution, as the developer that is carried into the "fixing" bath soon oxidizes and turns the whole bath dark. Ordinarily, with a fresh bath this will not harm, but if it is allowed to become old the negatives will be apt to stain when fixed in such a bath. A PLAIN hypo bath discolors more readily than an ACID bath. The hypo is good as long as it will fix and leave no scum or stain on the plate. If you have no regular fixing box keep your hypo solution in a bottle and in a dark, cool place, and pour it in the tray only when you are ready to use it. Never keep your hypo or developer in a metal pail or can, as the metal would produce a chemical action which would result in the spoiling of your bath. If a scum forms on the surface of the bath, remove it before placing a negative in to fix. If allowed to remain on the bath the scum will adhere to the back of the negative, and when dry is very difficult to remove.

162. **Softening of Film in Wash Water.**—This will occur if your developer, hypo or wash water is too warm. Prepare a weak solution of powdered alum, say one-half ounce of alum in 10 ounces of water, and place your plate in this alum solution imme-

diately after fixing, previously rinsing for a few moments. This alum will harden the film.

163. **Negatives Dry Slowly.**—The room is either too cold or poorly ventilated. Ordinarily it takes a negative from four to six hours to dry. With good ventilation and a temperature of 70 deg. to (not over) 85 deg. Fahr., the ordinary coated plate will dry easily in three hours' time. Do not dry by excessive heat; if the temperature is much over 90 deg. Fahr., the emulsion will become soft and run off the glass or celluloid film, ruining the negative.

164. **Negatives Appear Greasy When Dry.**—Lack of washing after fixing. This difficulty will not occur if fresh hypo solution is used and the negative is washed for the proper length of time (one hour in running water or in ten changes of water for the same length of time). The scum mentioned under the former DIFFICULTY, "Fixing Bath Discolors After Slight Use," is the cause of the greasy appearance on the dried negative.

165. **Negatives Appear Gritty When Dry (Dirty).**—Caused by sediment in the wash water. Before placing the negative in the drying rack, wipe both sides of the negative carefully with a tuft of absorbent cotton thoroughly saturated with water. If you are using a washing box, clean it just before you are ready to wash the negatives. Sometimes negatives will collect dust and dirt while drying. This is caused by using dusty drying racks, or, if no racks are used, by placing the negatives on a dusty table or other support. Always lay a clean sheet of paper, or blotter, under the negatives while drying.

CHAPTER V.

Kodaks and Films.

166. This section is devoted to Kodak and Film Photography, including the manipulation of kodak or other film cameras and the handling and developing of the different classes of films, *i. e.*, Eastman N.-C., Ansco, Lumiere, Ensign, etc., Kodoid Plates and the Film Pack.

167. The chemical manipulation of all transparent films is the same; but as they are put up in different ways, the preparation and method of handling in development differs to a certain extent. Instruction for loading the kodak or camera always accompanies the instrument; therefore, we will not dwell at length upon the preliminary operations. At the present time the old "Regular" Roll Film is a thing of the past, and the general instruction given here will apply directly to the various "non-curling" films which are in general use.

168. With the exception of loading, the general principles of the film kodak or camera are identical with the glass plate instruments, and, therefore, the previous chapters are applicable, and should be read by the student who enters his photographic career with a kodak or other film camera. Also read the booklet which comes with the kodak or film camera. Make yourself perfectly familiar with the instrument, taking special care to learn how the shutter works, and if it is a folding kodak apply the rack and pinion

for focusing. Note the use of the focusing scale, the rising front, etc. Before threading up the film, work the shutter for both time and instantaneous exposures. The first thing for the beginner to bear in mind is that the light which serves to impress the photographic image upon the sensitive film in a fraction of a second, as it comes through the lens, can also spoil the film as quickly as it takes the picture. The film must not be exposed to *white light* of any kind—gas, oil, candle, electric, etc.,—until it has been developed and washed, or it will be ruined. Therefore, care must be exercised throughout all operations of loading and unloading, to keep the black paper wound tightly around the film to prevent admission of light.

169. **Non-Curling Film.**—In the non-curling film the tendency to curl is overcome by a process explained below—hence the name non-curling. This film is usually also orthochromatic, reproducing practically perfect color-values. It is free from electrical markings, possesses great latitude in exposure, and is not subject to halation, due to the thinness of the support and the close proximity of the protective black backing. A marked advantage of the non-curling film is its great speed, which means much to the worker on dull, smoky days.

170. The curling of the film is overcome by coating both sides of the celluloid with gelatin; therefore greater care must be exercised in the handling, and neither side must come in contact with anything while drying. (See Paragraph 209 regarding drying.)

171. As these films are very rapid and orthochromatic they should be handled carefully in the dark-room by the

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By J. S. Neary

ruby light. The light should not be too strong—film being susceptible to color rays. If the ruby light is too strong, even though of the correct color, it will fog the film. We advise developing as far away from the ruby light as possible. A safe precaution would be to place an extra piece of yellow post office paper over the ruby light. This paper can be obtained from any photographic supply dealer.

172. Non-curling films, being gelatin coated on both sides, must be fixed in an acid fixing bath, or else be immersed in an alum bath after fixing. (See Paragraph 205.)

173. **Daylight Loading Films.**—Daylight loading spool films, as the name implies, can be loaded into the camera in daylight. The operation should be carried on in subdued light, and not in bright sunlight, however. Spool films are made in all sizes to fit all sizes of cameras, and are of varying lengths, providing sufficient film for four exposures (called double two exposures), six exposures and twelve exposures, except with certain kinds of cameras, such as the Panoram, with which the number of exposures to the spool is not so great. At the back or side of your film camera are receptacles for the spool of film, and an empty spool on which to wind the film. The blank spool should be set in the space or receptacle that is regulated by the winding key on the outside of the kodak. Now, break the gummed slip that holds down the end of the black paper on the spool containing the unexposed film, and insert this spool in the other receptacle.

174. In most of the box type of kodaks, the end of the black paper is next passed across the opening in the back of the roll holder and under the pasteboard flap, and threaded

through the slit in the empty reel. *Be careful to have the paper draw straight and true,* then give the spool *two or three* forward turns (to the left from the key end). With the folding types of kodaks simply draw the end of the black paper across the back of the camera and insert it in the blank spool.

175. **Important.**—Be sure that the paper rolls from the outer side of the spool. Since each spool is marked *"top"* on one end, when inserting look for the mark and be guided accordingly. Should you insert the film spool wrong, the black paper backing would come between the film and the lens, thereby making the exposure upon the paper in place of the film, and when removing from the camera the film not being protected by the paper, the result will be a complete loss of the roll of film. The winding spool has a slot in one end, into which fits the flange of the winding key.

176. CAUTION. If you reel off too much of the black paper, *before the camera is closed,* the film will be uncovered and, of course, ruined. Be sure your camera is closed perfectly before unwinding the film.

177. After the kodak is closed, turn the key to the left, until the number 1 appears before the little red window in the back of the camera. The film is now in position for taking the first picture.

178. **Double-two Film.**—We recommend what is known as the "double-two" films, as they are more convenient for your experiments. If you were to employ the six or twelve exposure films, there would be a loss of film as well as of time. This double-two film is for four exposures, and is so arranged that, after two exposures have been made, you can cut off the exposed film without any danger of

fogging the two remaining ones. This is done by turning the black paper, which separates exposures 1 and 2 from 3 and 4, until the letter S (indicating Stop) appears at the little red window, which indicates the number of the exposure.

179. Now open your camera and cut the black paper where it is marked "cut here." Then insert the empty spool, saved from former exposed rolls, in place of the spool just removed. Attach the end of the black paper to this spool and proceed to load your kodak in the same manner as at first. Attach the end of the paper to the spool, close the camera and wind the film, until No. 3 shows, when you are ready for the third exposure. After you have made exposure No. 4, and previous to opening the camera to remove the film, be sure to wind the strip of black paper around the film. Wind until you hear the click of the paper being released from the other spool. If you cannot secure the "double-two" films, get the six exposure films. They can be obtained from any dealer in photographic supplies.

180. **Instantaneous Exposures.**—(Snap-shots.) Most of the box types of kodaks have shutters which are always set and are operated by pushing the lever alternately to right or left with the thumb. If the spring is pushed the wrong way, the shutter remains unmoved, and no "click" is heard. This, of course, means that the lever should be pushed in the opposite direction. The manipulation of other shutters is clearly defined in paragraphs 53 to 56 of Chapter II.

181. To take instantaneous pictures with box kodaks and the cheaper forms of folding kodaks, the object you are photographing should be in strong sunlight, but the camera

should never be pointed toward the sun, which should fall from the back or over the shoulder of the operator.

182. "Snap-shots" are made with the largest stop. If a smaller stop or opening is used, the volume of light is so much reduced that it will not sufficiently impress the image on the sensitive emulsion of the film, and failure results. For the use of stops see paragraph 60 of Chapter II.

183. Time exposures should not be made unless you place the kodak on something solid, as the slightest jar will cause a blur, or at least, an indistinct image. Therefore, it must rest on some firm support during the exposure. A regular tripod is the best, as you can adjust it to any height. Whether making instantaneous or time exposures, have the instrument perfectly level. *In making interior pictures, give time exposures* and never point the lens toward a window. If all of the windows cannot be excluded, pull down the shades of such as come into view of the camera.

184. **Interior Exposures.**—The exposure necessary for interiors varies according to the light conditions and surroundings. By consulting the table below, you will be able to judge very closely the exposure necessary. This table is for the largest stop. If the kodak is of the box type, with three different openings, use the middle sized stop to obtain more sharpness, and double the time. When the smallest stop is used, give four times the exposure you would give with the largest opening.

EXPOSURE TABLE.

185. White walls and more than one window:

Bright sunlight outside, 2 seconds; hazy sun, 5 seconds; cloudy bright, 10 seconds; cloudy dull, 20 seconds.

186. White walls and only one window:

Bright sun outside, 3 seconds; hazy sun, 8 seconds; cloudy bright, 15 seconds; cloudy dull, 30 seconds.

187. Medium colored walls and hangings, and more than one window:

Bright sun outside, 4 seconds; hazy sun, 10 seconds; cloudy bright, 20 seconds; cloudy dull, 40 seconds.

188. Medium colored walls and hangings and only one window:

Bright sun outside, 6 seconds; hazy sun, 15 seconds; cloudy bright, 30 seconds; cloudy dull, 60 seconds.

189. Dark colored walls and hangings and more than one window:

Bright sun outside, 10 seconds; hazy sun, 20 seconds; cloudy bright, 40 seconds; cloudy dull, 1 minute and 20 seconds.

190. Dark colored walls and hangings and only one window:

Bright sun outside, 20 seconds; hazy sun, 40 seconds; cloudy bright, 1 minute, 20 seconds; cloudy dull, 2 minutes, 40 seconds.

191. This table is intended for rooms with windows receiving the direct light from the sky, and for the hours from three hours after sunrise until three hours before sunset. If earlier or later the time required will be longer.

192. **Exterior Exposures.**—When the size of the diaphragm of the lens is reduced to, say, about half, the light admitted through a lens is so much reduced that even out of doors a time exposure may be made just the same as for interior pictures; but as the light out doors is much stronger the time exposure must be correspondingly shorter. With sunshine the shutter can hardly be opened and closed quickly enough to avoid over-exposure. With light clouds, from

one-half to one second will be enough. With heavy clouds, from two to five seconds exposure will be required. This is calculated for the time from three hours after sunrise until three hours before sunset, and for objects in the open light. For other times, or for objects in shadow, under porches or trees, no accurate directions can be given; in fact, experience only can teach you to give the proper exposure. Remember, that time exposures cannot be made while the camera is held in the hand. Always place it on some firm support—tripod preferred.

Practice Work.

193. In order to become familiar with the proper timing under all strengths of light, take your camera and load it with a double-two film. Select a sunshiny day, and a street that has bright sunlight on one side and shade on the other. Step into the middle of the street and photograph the view which is in bright sunlight, setting the speed of the shutter at $\frac{1}{25}$, or if your camera is not equipped with a shutter of different speeds, use the instantaneous attachment, adjusting the view on the finder so that the far end of the street will show in the picture. Then make the exposure, after which turn off the exposed film until number **2** appears. Make another exposure identical with the first. Then wind off this exposure until number **3** appears, which means quite a number of turns (if a double-two film has been used), as a long strip of black paper separates number **2** from number **3**.

194. If you have not used a tripod or some solid support for the kodak in making the first two exposures, do so

for the remaining two exposures, as one of these is to be a time exposure, and it is impossible to hold the camera steady *even for one second.* Now, without changing your original location, point the camera toward the shady side of the street and make another exposure, giving the same "snap-shot" time as you did on **1** and **2**, after which wind up the exposed film until number **4** appears. Then set your shutter so as to make an exposure of one-half second, or if your camera is not equipped with a shutter that can be set at the different speeds, set it for time exposure, indicated on the dial by **T**.

195. When the shutter is set for a time exposure, you will have to press the bulb or button, or push the lever *twice* (depending on the kind of shutter you have). The first pressure opens the shutter and exposes the film; the second pressure closes the shutter. If you open and close the shutter as quickly as possible (without jarring the camera), you will secure an exposure of about one-half second. In making time exposures, do not move the camera in the least, for in so doing you blur the image on the film. After making the fourth exposure, remove the film as previously directed. Three of these exposures are properly timed; numbers **1** and **2** in strong sunlight and number **4** of the shady side of the street, to which you gave one-half second exposure. This one-half second exposure, made of the shady side of the street, will not affect the sensitive film any more than the snap-shot on the sunny side of the street did. Number **3**, which is a snap-shot of the shady side of the street, will be under-timed and yield a very poor picture. Our object in having this under-timed exposure is to show that snap-shot exposures cannot be made of any subject in the shade.

196. It is not necessary to use a street scene for these experiments. Any view will do which shows strong sunlight and shadow. You can apply the same method to a house first making an exposure from a point with the sun shining on the house, then making another exposure on the side in shadow. Both exposures will illustrate the same effect. With a 6-exposure film, expose numbers **5** and **6** on some public building or residence, making instantaneous exposures of both under different circumstances.

197. **Removing Film from Kodak.**—No dark-room is required for changing the spools. The operation can be performed in the open air, but to avoid all liability of fogging the edges it is advisable to remove the film in a subdued light. When the last film has been exposed in the kodak give the key about a dozen turns, thus covering the film with black paper again. Remove the spool from the kodak in exactly the reverse manner in which you loaded it. Be sure that the black paper is wrapped tightly around the spool of film; then fasten down the end of the black paper with the piece of gummed paper usually attached to the end of roll, or with a rubber band or piece of twine. It is further advisable to wrap this exposed film in black paper until you are ready to develop it. After removing an exposed film from the camera, take the empty spool from its recess and transfer to the winding side, bringing the slotted end of the spool, into which the key is to fit, opposite the keyhole and proceed to load the kodak with a new film, as at first directed.

198. **Film Development.**—Read carefully the description of a dark-room which is given in Chapter II, in paragraphs 95 to 98. With very few exceptions the development

of a film is the same as of plates, and you will need precisely the same outfit; viz., a good ruby lamp, four trays, a measuring glass, stirring rod, developer, and fixing chemicals.

199. Fill one of the trays nearly full of clear water and place this tray at your extreme left, on the developing table. Open one of the developing powders and dissolve according to the directions given in Chapter III, paragraph No. 117; then pour this solution into a second tray placing the tray

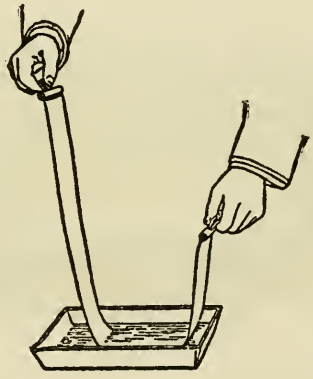

Illustration No. 24.

next to the water. Now close the dark-room door. To develop the film, unroll it and detach the entire strip from the black paper. Pass the film through the tray of clear water several times (see Illustration 24,) holding one end in each hand. This wets the surface of the film and enables the developer to come in perfect contact with the emulsion, when the film is placed in the developer. Now pass the film through the developer in exactly the same manner as you did while wetting it, but face down. Keep the film contin-

ually in motion, and in about one minute the high-lights (the strongest lights) will begin to show up darker. The unexposed portions will be distinguishable from the exposed, and in about two minutes you will be able to make out various objects in the picture.

200. An improvement on the ordinary tray for developing films will be found in the Ingento Film Trough. This trough is specially adapted for the developing of roll films by hand, as will be seen by Illustration No. 25. It is fitted with a rod adjusted near the bottom of the trough. The

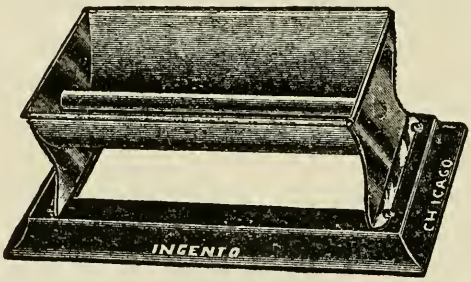

Illustration No. 25.

film is slipped underneath this rod and drawn up and down during the development, the rod holding the film under the solution all the while. This trough is seven inches long, and will accommodate all sizes of films from 5x7 down to the smallest. The trough is supplied with wood or metal base; the latter is preferable, as its weight prevents the trough from tipping over, while the wood base would need to be fastened to the table. When this trough is employed, it may be filled with water and used for wetting the film, after which the water is poured off and developer poured into the trough and the film developed.

201. If the film develops evenly it shows that all exposures were uniform, considering the amount of illumination—development may be completed without cutting them apart. The progress of development may be watched by holding the film up to the ruby light, from time to time. Read paragraph 124, of Chapter III, to judge when development is complete. If some exposures on the film flash up more quickly than the others, cut the film apart with a pair of shears and place the film in a tray of clear water. The cut films may be immersed in the developer and developed in the usual manner, carrying the over-exposures farther than the others, in order to secure the proper amount of contrast. When each film is completely developed, transfer to the third tray and rinse two or three times with clear, cold water. Then place in the "fixing bath." (See paragraph 125.)

202. **Cutting Films.**—It is sometimes found preferable to cut the film up into the individual exposures before development. In this case you must exercise care in unrolling the film, so that the film does not roll up over the paper. The exposures should be cut apart with the paper on top. Cut by the marks appearing midway between the figures in the center of the black paper. In cutting Panoram films, follow the special instructions given in the manual accompanying the Panoram camera. Proceed to develop the individual films, according to the directions for developing the roll of film, keeping the face side of the film down, in order to prevent curling.

203. **Rinsing Films.**—When the films are developed rinse them in three changes of water, and then pass them into the acid fixing bath. This can be made up from the perpared fixing powders, which only call for the addi-

tion of water; or by the student himself, according to the following formula:

204. **Formula for Acid Fixing Bath.**

Water	16 ounces
Hyposulphite of Soda	4 ounces
Sulphite of Soda	80 grains

When this is fully dissolved add:

Powdered Alum	⅛ ounce
Citric Acid	⅛ ounce

In place of the Citric Acid you may use ¾ ounce Acetic Acid, but you must be sure that it contains 25 per cent. pure acid.

205. This bath can be used repeatedly so long as it retains its strength and remains sufficiently clear not to stain the film. The regular acid hypo fixing bath can be purchased in powdered form, ready for use, from any photographic stock house. There should be sufficient fixing solution in your tray to completely cover the films when immersed during the entire process of fixing, as otherwise the films will fix unevenly and stains will be produced if they are left partly exposed to the air. Non-curling films can be fixed in the plain hypo bath recommended for plates but when using this bath the films must be rinsed in three changes of clear water after fixing, and then placed into an alum bath prepared as follows:

Water	16 ounces
Alum (crystals)	1 ounce

Of this solution decant into a tray enough of the clear liquid to cover the films, and allow them to remain in this bath

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By Grace E. Mounts

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for five minutes; then wash in the ordinary manner. The alum hypo bath can be used continually until it becomes discolored or so exhausted that it will not harden the film.

206. **Washing Films.**—The hypo must be thoroughly removed from the film. There are several ways of doing this. Place the film in a wash-bowl of cold water and allow it to soak, for five minutes each, in five changes of cold water, moving it about occasionally to insure the water acting uniformly upon it. Or, give it a couple of changes as above, and then leave the film for an hour in a bowl set under a tap of running water.

207. With a bath tub and a piece of pine board available, the following is a very convenient way to wash film negatives: The board must be a little longer and a trifle wider than your strip of negatives. Pin the strip, back down (the back is the shiny side), upon the board, being careful not to touch the faces of the negatives with your fingers. Run cold water to a depth of six inches into the bath tub, and then float your board in the tub, film side down. The hypo, being heavier than the water, will go to the bottom of the tub, and in half an hour your films will be completely washed. The hypo cannot be removed from films by simply leaving these in a basin or tray of water. Hypo is heavier than water and sinks to the bottom, and the films, also, are heavier than water. Consequently, unless the water is continually changing, or is changed every few moments, the films are never actually out of the hypo solution, and cannot thus be expected to become free of the hypo. Only by generous washing in fresh water can the hypo be properly removed from films or plates.

208. **Care of Wet Films.**—Owing to their flexibility, films stand greater chances of becoming injured and the emulsion separated from the celluloid support than do glass plates. Therefore, it is necessary to handle the film, in all of the various solutions, with exceptional care and the temperature of all the baths should never be over 65° Fahr. Especially is this true in summer or in hot climates, when you should have your developing tray placed in another tray of water containing a small piece of ice, or running water.

209. **Drying Films.**—When thoroughly washed, remove the surplus water from the film with a flat, soft rubber squeegee, a soft, damp cloth, or a damp ball of cotton, treating both sides of the film alike. To do this lay the film on a piece of glass or on oilcloth, and pass the squeegee or damp cloth over it, being careful that there is no grit on the squeegee or the cloth to scratch the film. Remove all the surplus moisture before hanging up to dry. If the moisture and tear drops are not removed they will cause transparent spots and streaks, which will show black in the print. Stretch a string across the corner of the room. Bend two pins like fish hooks. Push these through the corners of one end of the film to the heads, and hook one end of the film over the string; or, use the metal or wooden photo clips which can be bought at any dealer's. After the films are dry, keep them flat by placing them in a book.

210. This instruction is intended to train the beginner in the use of the proper light, to make a snap-shot or time exposure, and also to serve as a primary lesson in developing films.

211. **Kodoid Plates or Cut Films.**—Kodoid plates or cut films are used in the regular plate holders in the same manner as glass plates. They are, practically speaking, cut non-curling films, fastened on a card mount or support by retaining clips. As Kodoid plates are very rapid, and orthochromatic, they must be handled only in a safe ruby light to avoid fogging. To load your plate holders with the Kodoid plates proceed according to the directions given in Chapter II, paragraphs 92 and 93, for loading glass plates. After the exposure, and when you are ready to develop the negatives, remove the film from the mount by pulling off the retaining clips with a knife blade. Slip the film into the developer, with the face side down (the face is the dull side), keeping it moving to avoid air-bells. As soon as it is thoroughly wet with developer it may be turned face up. The general manipulation during the development is the same as for the handling of roll film.

212. As with roll films, there is danger of the emulsion on Kodoid plates becoming soft, unless all solutions are maintained at a low temperature. After the Kodoid plate is developed, rinse it two or three times and transfer to a saturated solution of common alum for a couple of minutes. Then it can be placed in a plain hypo bath, made up of one ounce of hyposulphite of soda dissolved in four ounces of water, but if possible, employ an acid hypo bath; then it is not necessary to place the film in the alum hardening solution. The process of fixing, washing and drying must be carried on exactly as prescribed in paragraphs 202 to 209 for the fixing, washing and drying of roll and cut films.

213. **Film Pack.**—The pleasure of making pictures, to those who desire to use a regular plate camera, is often

marred by the burden of glass plates which have to be carried. The student may not wish to buy a roll holder attachment which will accommodate roll films, and yet the weight and bulk of plates may deter him from much of the instruction and pleasure he can gain with his camera. Also, there is a distinct advantage in being able to focus on the ground-glass and see each picture before the exposure, which is not practical with the folding film cameras. This problem has been worked out in a very simple and effective manner. The film pack is the solution, and the value of what, to many, has always been the most desirable of photographic instruments, namely, the plate camera, is thereby enormously increased.

214. The film pack consists of twelve flat cut films packed together in a light-proof paper case the size of an ordinary plate holder, with an opening on one side the exact size and shape of the film to be exposed. From the top of this case thirteen black paper tabs protrude, twelve of which are the ends of the black paper lying between each film, and the remaining one, marked "safety cover," being the end of the black paper which protects the entire pack from light. Each of the twelve tabs is numbered, the numbers referring to the different sheets of film to which the tabs are attached.

215. The complete pack weighs less than an ordinary plate holder, although containing material for twelve exposures instead of two. The operation of the film pack is to the last degree simple. There is an inexpensive adapter (see Illustration No. 26 of a Film Pack Adapter) to take the place of the plate holder and a film pack to take the place of the plates. The film pack can be loaded into the adapter

Illustration No. 26
Film Pack
See Paragraph No. 215

Illustration No. 26*a*
Example of Fogging Caused by Failing to Wind Film Tightly on Spool
See Paragraph No. 229

in daylight, which is more simple and more convenient than loading the plate holder with dry plates.

216. After the picture is focused on the ground-glass, the adapter containing the film pack is inserted in the same manner as the regular plate holder. The label on the face of the pack should be broken previous to inserting it in the adapter. Having placed the adapter in position in the camera, remove the slide and pull out the tab on the film pack marked "safety cover," and film No. 1 is presented for exposure. When the exposure has been made, pull out from the pack the tab marked No. 1, which operation rolls film No. 1 around to the back of the pack, leaving No. 2 presented for exposure. This exposure being made, tab No. 2 is pulled out and film No. 3 is ready. Repeat the operation, removing the exposed films one at a time, as additional exposures are to be made.

217. As each tab is drawn out it must not be left attached to the pack, as it is of no further use. It should be torn off across the metal edge and thrown away. When all the tabs are pulled out and torn off, the pack is exhausted and has been automatically made light-tight by the pulling out of the last tab. The pack may then be taken from the camera in daylight and replaced by a fresh one. With the film pack one can make the whole twelve exposures in as many seconds. If one desires to focus on the ground-glass between each exposure, replace the dark slide and, like a plate holder, the adapter containing the film pack may be safely removed.

218. If you desire to substitute plates for films, you can readily do so, as the adapter and pack may be removed at any time. Plate holder and plate can be substituted for

any desired exposure, the film operation being afterward resumed by the insertion of the adapter containing the pack.

219. **CAUTION.** When pulling out any black tab with one hand press the remaining tabs under your finger or thumb of the other hand. This will prevent the possibility of pulling out of more than one tab at a time.

220. The films used in the film pack do not curl upon development. Like roll films, they are non-halation, and also orthochromatic to a marked degree, being very sensitive to yellow, which makes them very rapid and of special value on dull or "yellow" days. The films are, of course, unbreakable and can be sent through the mail.

221. Another feature of the film pack is, that any number of films can be removed and developed without touching the unexposed films remaining in the pack. To remove one or more films for development, before the entire pack is exposed, proceed as follows:

222. **Removing Films from Film Pack.**—Take the camera or adapter to the dark-room, remove the pack and break the red seal at the sides, near the bottom, which will open the pack, thus giving access to the exposed films. After removing the exposed films, the pack can be replaced, without sealing, in the camera or adapter before leaving the dark-room, when everything is ready for additional exposures. The films are attached to black paper supports at one end and they may be readily separated, but care should be exercised when separating the paper, for tearing them apart quickly will, by the friction, cause electric sparks which will generally fog the film. One may develop the films singly if desired. The paper supports are numbered to correspond

THE AFTER GLOW

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By H. H. Boyce

with the tabs, so that by noting a given exposure, at the time of making it, proper treatment may be given this particular film.

223. **Developing Film Pack Negatives.**—Throughout the process of development, etc., care should be taken not to touch the face of the film. After the film is placed in the developer, the tray should be kept constantly in motion until the desired density is obtained. This film should be placed in all the solutions face downward.

224. The development of the films used in the film pack is identical with that of the cut films, or of the dry plate, with the exception that the latter is developed face up. For developing we recommend the prepared powders referred to in the Film Instruction.

225. If a number of films are to be fixed together in one tray, they should be put in one at a time, face down, to avoid scratching, and they should be handled over occasionally to avoid matting together and insure thorough fixing. After fixing, wash thoroughly before drying. Use the regular Hypo Acid Fixing Bath.

226. To dry, pin the film up by one corner to the edge of a shelf or similar projection, being sure that it swings clear of the wall in order that nothing may come in contact with either side until thoroughly dry.

CHAPTER VI.

KODAKS AND FILMS—DIFFICULTIES.

227. **Loading Roll Film in Kodak.**—No difficulty will be experienced if, in loading the roll into the kodak, you follow the instructions which accompany each roll of film. If the spool does not slip into place easily you no doubt are handling it so that the ends of the spool are not parallel with the sides of the camera. It is necessary, in some of the types of kodaks, to pull out or turn to the left the little pins which hold the film in place. These pins extend through each side of the camera and must be withdrawn previous to the insertion of the spool. The spool will then drop into its proper position; after which the pins are turned or pushed in so as to fit snugly into the center of the spool. After tearing loose the paper band that keeps the black paper from unwinding, unroll enough of the black paper to reach the winding spool, and as soon as you have fastened it into this spool, give it a couple of turns.

228. The back is now replaced so as to exclude all light from the interior. Keep on turning the spool until you see in the little red window the hand or the number 1; if instead of a number a white surface suddenly comes before the red window, you may know immediately that you have placed the roll of film in the holder wrong. The film, in place of drawing from over the top of the roll, is very likely drawing from underneath; consequently the film side of the roll is facing out instead of in toward the lens; in other words, the black paper is between the film and the lens. Before winding any further from the spool, take the camera to your dark-room and remove both spools; wind the black paper and film back to the original spool and then reinsert the spools in position properly.

229. **Winding Film in Kodak.**—Illustration 26*a* shows a section of film which was not wound tightly on the spool, the portion of it buckling outward, thus admitting a streak of light which caused the fog across the middle of the film negative and also the fog at the sides. Care must always be exercised to keep the spool tightly wound in the camera and also tightly wound when removing it from the holder. Immediately after removing the exposed roll from the camera fasten the end of the black paper with the strip of gummed paper which accompanies the spool; or you can use a rubber band. Previous to inserting the roll of film in the camera, be sure that the shutter is closed; for, after you have placed the film into position for the first exposure, should the lens be opened you will immediately fog the film. Having once unrolled the film the shutter must be always kept closed, except when making exposures.

230. **Double Exposure on a Film.**—After you have made the first exposure, turn the winding key until the figure 2 appears at the little red window, at the rear of the camera, indicating that the film is ready for the next picture. Should you neglect to turn the film immediately after making exposure, you are very apt to make a double exposure on the section which has already been exposed.

231. **Double and Blurred Images.**—Double and blurred images will occur, when making time exposures, if the object moves; or the camera itself may have been moved or shaken during the exposure. For all time exposures the instrument must remain perfectly rigid (unmoved) during the exposure. It is very essential to have a tripod, although for interior work it is feasible to set the camera on a small table or stand and secure satisfactory results, but the tripod is more convenient.

232. **Development Difficulties.**—The difficulties which occur in development will be practically the same as those described under the difficulties given for developing the dry plate.

233. **Streaks and Light Spots Caused During Development.**—Difficulties will occur when the film has not been properly—i. e. completely—immersed in the developer at the very start. Soak the film, for half a minute or so, in clear water, before placing it in

the developer, thus softening the emulsion to a certain extent and wetting its surface so that the developer may immediately begin its action on all portions at identically the same time. Place the film in the developer with the emulsion (dull) side down and keep it moving in the developer.

234. **White Spots on Film After Fixing.**—This would indicate that the film was not entirely immersed in the hypo, or that parts of the film had become stuck together, thus preventing these white portions from becoming fixed. Always handle and separate the film a few times during fixing.

235. **Pencil Lines on Film.**—These are caused in two distinctly different ways: First, if there is any dust in the camera or if the rollers over which the film runs are not absolutely smooth, the film will be scratched or the dust in the camera, collecting on these rollers, will cause black scratches and streaks longitudinally across the developed film. Second, should you draw the film with the emulsion side down through the developer, so that the film strikes the bottom of the tray, it is likely to be scratched. Abrasion marks will immediately appear, which reproduce in the finished print as white lines.

236. Since there is no way of remedying these lines and streaks upon the film, exercise the greatest of care, when developing the film, not to allow its surface to come in contact with anything excepting the solution. In fact, this caution must be observed during every stage of the handling of the film, from the removal from the camera to the placing in the printing frame. Do not allow your fingers to come in contact with either side of the film, even when it is dry. When it is necessary to handle the film, take hold of the extreme edges only. All films on the market at the present time are non-curling, and during the process of manufacture, in order to make them non-curling, both sides of the celluloid support are coated with gelatin. The gelatin on the back of the film, however, is not sensitized, but is merely a coating to keep the film from curling.

237. **Blank Spaces in the Developed Roll Film.**—Should you observe spaces in the film that are entirely blank, you have either

very much undertimed that particular exposure or else your shutter did not work and no exposure was given. Upon developing further, should an exposure, which at the beginning appeared perfectly blank, commence to build up a trifle, cut out this film and place it in a tray of clear water. Let it remain there until you have completed the development of the film; then, take this under-exposed section of the film and place it in fresh developer. It should immediately commence to build up in density and in detail, although, in the majority of cases of under-exposure, the film will gain but little strength and it will be necessary to again place the film back into clear water, where it should remain undisturbed for five minutes or so. Repeat this operation from the clear water to the developer a number of times, allowing the film to remain in each for a period of four or five minutes. By this means you will obtain all the strength and detail possible in an under-exposed film. While in the developer remember the film should be kept in continual motion. This will assist the development and also prevent spots; but, while in the water the film should not be disturbed.

238. **Black Sections in the Roll Film.**—After placing the roll film in the developer, should certain exposures flash up black all over, it is a sign of fog or extreme over-exposure. In that case, nothing can be done to save it and all attention should be given to the remaining exposures.

239. **Securing Uniform Exposures on Roll Film.**—Those using roll film should make an effort to secure exposures as uniform as possible, as that will greatly facilitate work in the dark-room, and will also produce superior results. Time exposures and snapshots, to be successful, should not be made on the same roll of film. If they are, carefully judge the time necessary, so that long exposures in subdued or weak light will not have a greater effect on the film than the snap-shot in bright sunlight. Judge your light before making the exposure. If extremely strong, or should you be making snow pictures, with bright sunlight shining upon the snow, stop your lens down to f/16 or f/32 and use the instantaneous shutter or the 1-50 of a second. Then, when you come to make an exposure, on the same roll of film, of a dark object in the shade, use the lens practically wide open and give what you think the

proper exposure; i. e., a corresponding exposure according to the light, which would be about one-half second. If you wish to make an interior of a room, not very well lighted, stop down to secure the desired depth of sharp focus. If you stop down to f/64 it may be necessary to give a minute's exposure to get a fully timed negative.

240. It is difficult to give absolutely correct directions for the making of the exposure, as light conditions are so different in almost every case, that it is necessary to experiment and to exercise considerable judgment.

241. **Difficulties with Cut Films, Film Pack, Etc.**—The difficulties we have mentioned in the development of a roll film will apply equally to all cut films. Cut films should be developed face side down, and care must be exercised not to rub the edges of the film, which will loosen the emulsion from the celluloid support; nor must the edges of the film be allowed to come in contact with the emulsion side of any other film, as the result would be scratches and torn sections upon that film.

242. **Softening of the Film.**—In warm weather there is always a tendency for the emulsion to become soft, which will result in blisters and excessive frilling around the edges. The temperature of the developer should never be over 65° Fahr. in summer, and it is very advisable to use an acid fixing bath, which will harden the emulsion on the film and do away with any possibility of its softening when placed in the final wash water.

243. **Drying.**—Films must be hung up to dry and never allowed to come in contact with any material whatever, for that material will stick to the film and ruin it.

CHAPTER VII.

Tank Developing for Films.
No Dark-Room Necessary.

244. Of all methods of developing films the developing machine or tank is the simplest, and with this simplicity is included the possibility of the very finest results.

245. By the tank method, of course, the action of the developer upon the film is all concealed—you see nothing until the negatives are completely developed, and, therefore, were you to begin your instruction with tank development you would not have a real knowledge of negative developing. For this reason it is essential that anyone intending to become thoroughly proficient in negative making first learn to develop in an open tray, where they can watch the operation and see what they are doing, and observe the progress of development of the latent image. In this way alone will you learn to understand and know what is to be expected from films exposed under various conditions. With a knowledge of the process of development based upon this practical experience, simplified methods may be employed and the developing tank brought into practical use.

246. From the foregoing it must not be inferred that the developing tank cannot be used from the very beginning. It can be employed successfully before the student has any experience with tray development whatever, but it is not possible for that student to have the practical knowl-

edge of negative making that is so essential if his individuality is to count for anything in his work.

247. For the amateur who cares nothing about the whys and wherefores—whose only desire is to secure records of vacation scenes, home surroundings, etc., for the pleasure of having such records, doing away with all *bother* —then the tank may be employed from the start. On the other hand, however, if negative making is to be thoroughly understood, then tray development, where one can watch the image grow, must be employed. Only with a knowledge of what is to be accomplished thoroughly impressed upon the mind can one appreciate the advantage of tank development and employ it intelligently.

248. The best known type of machine or tank for film development is the Eastman Film Tank. (See Illustration No. 27.) This tank is the successor to the original film machine, which was the first practical instrument of its nature, and in which the exposed film was enfolded in a protective celluloid apron, and at the same time made to rotate in the developing solution for a fixed period of time. The tank method differs from the machine, in that the exposed film is rolled up with the protective celluloid apron in one operation, and then the two together are brought into a tank or receptacle containing the developing solution, and there left for a given period of time, according to the strength and the temperature of the developer. This method is simpler than the former, in so far as the film does not require to be continuously rotated enabling the operator to proceed with some other work.

249. All tank development is based on the factors of time and temperature. *A given strength of developer at a cer-*

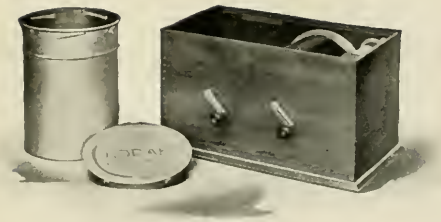


Illustration No. 27.
Eastman Film Tank.
See Paragraph No. 248.

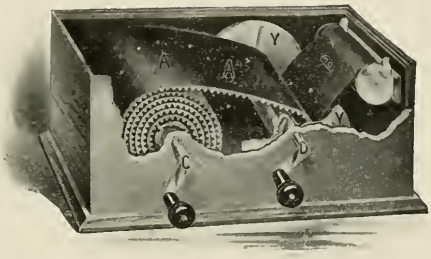


Illustration No. 28.
Winding Box.
See Paragraph No. 254.

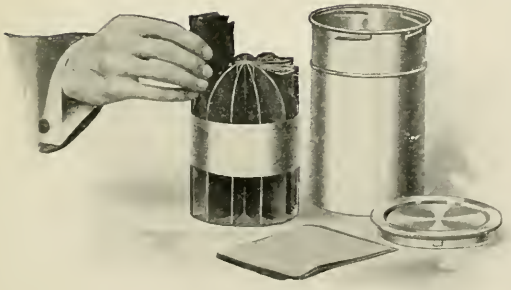
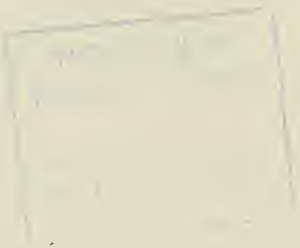


Illustration No. 29.
Premo Cut-Film Developing Tank.
See Paragraph No. 259.

Eastman Film Tank.



tain temperature, requires a given time for development. This is the principle back of all tank or stand development.

250. The normal temperature for developing solutions is between 60° and 70° Fahr., although in summer, or in tropical countries, the temperature should not be over 60°. When the developer is warm it works rapidly and produces a coarse grain on the film. When cold it acts slowly; therefore, to obtain uniform results it is necessary to have some knowledge of the effect of temperature and the speed of the developer before attempting to develop.

251. When prepared developing powders are used carefully follow the manufacturer's directions for preparing the solution. It is very important to have the developer mixed in exactly proper proportions each time.

252. A separate hypo dish should be provided for fixing the films. In the absence of a regular fixing box it is advisable to employ a shallow dish of good size, or a small pail. Use a liberal supply of solution which will cover the films well.

253. **Kodak Film Tank.**—The kodak film tank is well constructed, and is made in different sizes, accommodating films from the "Brownie" up to a 7-inch spool. For a number of years kodak developing machines held a very important position in the amateur's outfit. With the advent of tank development the machines have given place to the kodak film tank. This tank is not an experiment, for it is being used and enthusiastically endorsed by amateur and professional photographers the world over. Negatives of high average quality and uniformity are obtained by means of the tank. Furthermore, it is very convenient and affords the simplest means of developing the roll

film. Every step of the work may be performed in daylight, and the entire operation is so simple as to be readily understood by the merest novice.

254. The kodak film outfit consists of a winding box and a developing cup. The film, after exposure, is protected from light by being first wound upon a light proof apron, after which it is removed from the winding box and placed in a cup of developer until the development is completed. By reference to Illustration No. 28 you will observe that the apron, black paper and film are wound on axle D, and when so wound are at once removed from the box and placed in the *solution cup*—this is done in the light of an ordinary room. Development is allowed to go on for twenty minutes, and the film requires no attention during that time beyond turning the cup containing the film, end for end, three or four times during development—a tightly fitting cover for the cup being provided for this purpose. (In case of the Brownie film tank the film roll itself is turned.)

255. When development is completed the solution is poured off and the cup filled with water to wash out the developer. The water should be changed several times. After a few minutes of general rinsing in this way the film is ready for fixing. If the developer is well rinsed out the film may be taken from the apron and placed in a separate fixing bath. This process of fixing can be carried on in subdued daylight—the light of an ordinary room will do no harm.

256. If desired the fixing may be carried on in the same tank that was used for developing, by allowing the film to remain in the apron and fill the tank with hypo

solution and fix for twenty minutes, inverting the tank every five minutes to insure thorough fixing. The method necessitates thorough cleansing of the apron reel and tank after each operation, and while it is all right in cases of emergency, yet we consider it best to fix the film in a separate vessel.

257. With the **kodak film tank** one can develop a number of rolls of film at once, by merely providing oneself with extra tanks, aprons and reels. The one winding box will answer for any number of films.

Important.—Until perfectly familiar with its operation, it is advisable for the novice to work the winding box a few times without any film in it, and with the cover removed.

258. **Premo Cut-Film Developing Tank.**—The Premo Cut-Film Developing Tank is the latest application of the tank principle. The Premo tank provides for the development of cut-films, or the films from the film-pack, with a minimum of care and labor, and the assurance of uniform results. The Premo Film Tank, unlike the Kodak Roll Film Tank, must be loaded in the dark, but development may be carried on in daylight.

259. The Premo tank consists essentially of two pieces—a metal receiver or frame for holding the films, and a tank with cover for the developing solution. The receiver is divided into twelve compartments, in all sizes except the 5x7 size, which has but six, each compartment accommodating one film. As the film is taken from the pack it is held between the thumb and fingers, slightly curved from top to bottom, and slipped into its respective compartment (See Illustration No. 29.) When all com-

partments are filled the receiver is placed in the tank, which has been previously filled with the developer. The top is then replaced and the films are left to develop for a certain specified time. No further attention is necessary, excepting to turn the tank, end for end, three or four times during development. At the expiration of the full time open the tank, take out the receiver, remove the films, place them in a tray of water for a moment, then transfer to the fixing bath. When the development is completed rinse out receiver and tank, and set them aside to dry. If desired, films may be fixed in the same tank in which they were developed, but this is not recommended.

260. **Note.**—The operation of removing films from the pack and loading the receiver is done in a darkened room, by the light of a ruby lamp. During the day any darkened closet will suffice. To place the film in the receiver will require only two or three minutes, and as soon as the top is placed on the tank it may be brought out into any light and left until development is completed.

261. It is very seldom that films can be developed and prints made from them the same day; therefore, as the majority of amateur photographers find it more convenient to develop at night, we would suggest night time as being particularly appropriate. Any room can then be made perfectly dark and may be employed for loading the tank, after which the developing may be carried on in a lighted room.

262. If desired to develop less than a dozen films, one merely removes from his pack those films that have been exposed, and places them in the receiver as previously described.

263. **Developers for Kodak Film Tank.**—The tank developing powders will be found very convenient to use for either the film or the plate tank. These powders are compounded in accurate quantities, to be dissolved in a given amount of water. The powders are supplied in different size packages, so it is possible to make either a large or small bulk of solution to suit the size tank employed.

264. **Fixing.**—The prepared acid fixing powders may be employed if desired, or one can make up his own solution according to formula given in this chapter.

265. The bath should be prepared in a large jar, being certain that all of the chemicals are completely dissolved. When ready for fixing, pour into the tank or vessel used for fixing sufficient of the solution to completely cover the films. A liberal quantity should always be used. When films are fixed the bath may be returned to the original jar and saved for the next fixing. The fixing bath may be used over and over again, so long as it fixes the films in a reasonable time, or until it becomes discolored and shows signs of staining the film, when it should be discarded and replaced with a new bath. Do not over-work the fixing bath. While films should be completely fixed in ten minutes—*i. e.*, all the free silver removed, yet it is advisable to allow the film to remain in the bath for twenty minutes; the extra ten minutes will do no harm and will insure thorough fixing.

CHAPTER VIII.

Preparing Chemicals: Developing with Pyro.

266. Good results can be produced with the ready prepared powders and solutions, and for the beginner's first experiments they are recommended, as he will, without doubt, secure better results with them. However, the experience gained from the preceding instruction will enable you to readily recognize the necessity of knowing the action of the different chemicals employed and the manner of preparing the various ingredients for the developing solutions. The following instruction is, therefore, given, not alone that you may learn how to prepare these solutions, but the experience you will gain thereby will prepare you for the more advanced instruction in Volume II.

267. Don't measure your sodas by weight; use the *hydrometer* for testing them and you will always have uniform results. A *hydrometer* can be procured from any dealer in photographic supplies. If sodas in crystal form should dry to a powder, by exposure to air, or vice versa, the weight would be altered, although the strength of the original quantity would remain the same. Consequently a solution made by dissolving 1 oz. of the dry powder would be stronger than that made by dissolving 1 oz. of crystals in the same quantity of water. Also sodas of different brands, and even of the same brand, but procured at different times, are seldom of uniform strength. So if used

by weight instead of hydrometer you will be apt to meet with frequent failures.

268. **Hydrometer.**—The hydrometer used in photography is an instrument for measuring the number of grains of a certain chemical in an ounce of water. The instrument consists of a glass tube, near the bottom of which are two bulbs. The upper bulb is filled with air, the amount of which is sufficient to make the whole instrument lighter

Illustration No. 30.

than an equal volume of water. The lower and smaller bulb is loaded with mercury, in order that the instrument may remain in a vertical position when placed into the liquid to be tested. (See Illustration No. 30.)

269. The point to which the hydrometer sinks when placed in clear water is marked zero, the tube being graduated below this point in such a manner that the specific gravity of the liquid can be read. The *specific gravity*

of a body is the proportion between its weight and the weight of a like volume of pure water.

270. **How to Compound a Formula.**—First, be sure that your graduates, stirring rods, and any receptacles you may use are perfectly clean. *Many unexplainable troubles and failures will be avoided if you heed this caution.* The water you use should not be taken fresh from the tap, but should be allowed to stand for some little while, to permit the air to escape. If scales are used for weighing out the chemicals, care should be taken that they are perfectly clean and work accurately. Always add the chemicals one to the other in the sequence given in the formula, and see that one chemical is thoroughly dissolved before adding another. Keep the chemicals you use always in tightly corked bottles or tins, and be careful to label all your bottles so that you should not, by accident, get hold of the wrong solutions.

271. **Formula for Developing with Pyrogallic Acid.—**

Stock Solution No. 1.

Water	24 ounces
Pyro	1 ounce
Sulphuric Acid	5 drops

Stock Solution No. 2.

Sulphite of Soda (Anhydrous) Hydrometer test 70, or if by weight,

Sulphite of Soda (Anhydrous)	1 ounce
Water	8 ounces

Stock Solution No. 3.

Carbonate of Soda, Hydrometer test 40, or if by weight,

Carbonate of Soda (Anhydrous)	1 ounce
Water	10 ounces

If crystal sodas are used you will require 2 ozs. in place of 1 oz. anhydrous, as the anhydrous is twice as strong as the crystals.

We advise the use of the very best sodas. Do not buy the commercial brands.

To prepare this formula, first place 24 ozs. of water in your graduate; add the pyro, dissolving it thoroughly; then the drops of sulphuric acid should be added by holding the acid bottle in your right hand, with the little finger at the bottom of the bottle. Withdraw the stopper and hold your stirring rod to the mouth of the bottle, which will allow you to measure out the 5 drops very carefully.

272. To develop, take 1 oz. of No. 1; 1 oz. of No. 2; 1 oz. of No. 3, and add 6 ozs. of pure water in winter, and 8 ounces in summer. If your plates develop a yellow color, strengthen the sulphite, if there is a lack of color and the plate is a blue-gray, reduce the strength of your Sulphite Stock Solution, but use the same quantity.

273. Always bear in mind that *sulphite of soda* regulates the color value of the plate; *carbonate of soda* gives detail; and *pyro*, being the developing agent, gives strength and contrast.

274. If your negatives are yellow the sulphite is not strong enough. For instance, if you are using sulphite at 70 hydrometer test, then you must strengthen it to perhaps 80 test, all other chemicals remaining as they are. The color of the negative is regulated entirely by the strength of sulphite of soda. It will seldom, if ever, be necessary to change the strength of the carbonate of soda.

275. **Pyro**, which is the developing agent, is used to produce strength (density). If your plates develop up contrasty, use less of No. 1 (the Pyro Stock). This developer will work well with any brand of plates by following the above directions. If you are using a brand of plates that

will build up (strengthen) quickly, use more water. If, on the contrary, you cannot obtain the desired strength, reduce the amount of water, thus making the developer stronger.

276. For Seed, Standard and Stanley plates, also films, use according to formula; for Cramer plates, use 10 drams of pyro and 9 ozs. of water; for Hammer plates use only 6 drams of pyro and 8 ozs. of water, the sodas remaining the same for all plates.

277. **Fixing Bath.**—For fixing bath use plain hypo and water (4 ozs. hypo to 1 pt. of water), and during hot weather keep the bath cool. Allow plates to remain in this bath about 20 minutes, or about 10 minutes after all whiteness (bromide of silver) has disappeared. Should the plates show a tendency to frill in hot weather, prepare a hardening bath composed of ½ oz. of ground alum to 1 pt. of water, and immerse plates in same for two minutes, after fixing, and then transfer them to a washing box and wash for at least thirty minutes.

278. GENERAL NOTES.

Pyro.—*Too much pyro* clogs the whites. *Too little pyro* slows development; gives lack of brilliancy.

Alkali.—*Too much alkali*—Quick development; flat negatives; foggy and granular. *Too little alkali*—Slow development; contrast.

Sulphite.—*Too much sulphite*—Cold-gray tone. *Too little sulphite*—Warmer tone, inclined toward yellow.

Water.—*Too much water*—Thin high-lights; plenty of detail, but lack of snap and strength. *Too little water*—More contrast.

Temperature.—Normal, 65° to 70° Fahr. *Higher temperature*—Intensity and likely fog. *Lower temperature*—Flatness, lack of snap.

279. **Drying Negatives.**—The warmer and closer the atmosphere in which the negative is dried, the more dense it becomes. Whenever possible, negatives should be dried with an electric fan, or in a current of air, as the quicker they dry (within limit—say within a few hours) the finer the grain will be.

280. **Developing.**—All plates you believe to be properly exposed should be started in a normal developer. A correctly exposed plate can be completely developed with the formula for normal developer given in this instruction without any alteration whatsoever. It is advisable to always save the last developer used, pouring it into a large mouthed bottle and placing a cover over the bottle to protect it from dust. It is also well to use two trays when developing. Into one tray decant the clear solution of the old, or previously used, developer, adding one-third fresh stock solution thereto; use the other tray for normal developer.

281. **Restraining Development.**—If a plate flashes up quickly, indicating over-exposure, place it in the tray of old developer at once, rocking the tray quickly so that the bromide in the old developer, liberated from the emulsion of the plates previously developed, will penetrate the plate at once and check development. The bromide has a restraining action upon the shadows, but does not materially affect the action of the developing agent upon the high-lights, thereby permitting the developer to continue and produce the required contrast. Unless plates are very much overtimed, we advise using no other means of restraining than

those described above. It is well after a plate has been developing in the old developer for some time, to place it in fresh developer, in order to give snap and more crispness, always being careful to rock the tray.

282. **Developing Under-Exposures.**—In case the image appears slowly and with contrast, you will readily understand that the plate is undertimed. Then immediately place it in a tray of plain water. Cover the tray and allow the plate to remain for, say ten minutes; then conclude developing in normal developer. If the plate shows signs of extreme under-timing, make a new developer, weak in pyro (using only one-half the regular quantity), the regular amount of sulphite and carbonate of soda and double the amount of water. Conclude the developing in this bath instead of with normal developer. The resulting plate will be clear in detail. with no harsh high-lights.

283. **When Is a Plate Developed?**—The greatest difficulty in developing a plate is to know just when to stop. Conditions have so much to do with the proper developing of a plate, that it is hard to state exactly how to tell, under all circumstances, when to stop developing. A properly timed plate is completely developed, and carried far enough, when the contrast between the high-lights and shadows is as you would desire it, and as they appeared on the ground-glass, taking into consideration that the plate loses some of its strength in fixing.

284. Some brands of plates fix out more than others. For instance, Seed plates will lose about two degrees in the hypo bath, while others will lose about one shade of density; therefore, when judging if the plate is sufficiently dense, you must bear in mind the brand of plate and develop ac-

cordingly. In examining an over or under-timed plate, you must judge it for the same results as one properly timed, taking into consideration whatever effect the over-timing or irregular conditions may have upon it. Should the plate be slightly over-timed it will thicken up more rapidly, but must be carried further in the developer until the desired contrast, even in a very dense plate, is visible. If the plate has an even density throughout, when fixed, while it may be strong, it will lack the necessary contrast. So it must be carried far enough to produce this result, and stopped there.

285. After looking through your plate, if you are in doubt as to whether the proper density has been obtained, by looking at the back for the image, you can see how far through the film the developer has penetrated. If, upon examination, you find the proper contrast, and the image is fairly clear *on the back,* your plate is sufficiently developed.

286. Do not depend entirely by the appearance on the back, for in some cases plates will be fully developed before the image appears on the back at all, according to the thickness of the emulsion, which varies in different brands, and also to the length of exposure. In a plate that is slightly under-timed, necessitating weak, prolonged development, which enables the developer to penetrate the film more deeply, the image will appear more distinctly on the back than in a normal exposure in which the action of the developer is more on the surface and the image shows very dimly, or not at all, even when completely developed.

287. You will notice that the high-lights show through first, and if in looking through the plate the shadows appear weak, continue development until they show on the back.

In the case of a double-coated plate, fully timed, the highlights at least should show on the back; if not, the coating being double, the appearance when looking through the negative to the ruby light will be more dense than it really is, and if developed only as far as an ordinary plate it would be very thin when fixed.

CHAPTER IX.

General Hints on Development.

288. It is not a good plan to place the plate in water before development, nor to first pour the developer into a dish and then drop the plate into it. Both of these proceedings tend to cause the formation of air bubbles on the surface of the film; these adhere to the film, and, when once formed, are very difficult to get rid of, even when a brush is used. Where these formations occur on the film the developer cannot act, and thus an undeveloped spot is left, which fixes out in the hypo bath, leaving a clear, round spot or hole. Lay the dry plate (film side uppermost) in a dry dish, and then pour the developer over it in one sweep, so as to cover the plate all over with it at once. If a portion of the plate be left uncovered, even for only a few seconds, there will probably be a mark on the finished negative. In order to avoid this danger use plenty of developer. Rock the dish during development, constantly and in both directions. The object of this is two-fold. In the first place, it has a great influence on the vigor and brilliancy of the negative, because the action of the developer releases bromine from the silver bromide of the plate, which bromine immediately combines with the alkali, forming a bromide.

289. Now, bromide acts as a restrainer—*i. e.*, holds back development—and this *additional bromide*, if not distributed by rocking, remains in the developer at the place where formed, so that the development at that part of the plate is

additionally restrained. It will be easily seen that the most bromide will be formed and the greatest restraining action will result just at those places where action ought to be most vigorous. Less bromide will be formed in the less exposed parts. The latter will, therefore, develop more and the former less than they should, producing less contrast—flatness—in the resulting negative. Another result of rocking is to prevent a mottled appearance, which often shows itself when developer is not kept in motion. Do not fix the plate as soon as you see enough detail, but give enough time to acquire density also. It is perhaps the most difficult thing in development to judge when the image is dense enough, and such knowledege can only be acquired by experience with the particular brand of plates employed.

290. No two developing agents are alike in their results. Pyrogallic Acid, Eikonogen, Metol, Pyrocatechin and Hydroquinon, or combination of two or more of these, are the developers generally used. The conditions under which individuals must work are so varied that no one particular formula can be applicable to all. When strong, vigorous printing negatives are desired, pyrogallic acid, in combination with either carbonate of soda or carbonate of potash, is generally preferred; although by dilution and modification as much softness and detail can be produced with this as with any other developing agent. Quick development with strong solutions means a lack of gradation, a forcing up of the high-lights before the developer has time to act on the less exposed parts. Good results can be obtained only by slowly coaxing out the detail, so that all parts of the image come up fairly together.

291. *A developer containing too much alkali (carbonate*

of soda or potash) will cause flat, foggy negatives. All developers should be carefully filtered before use. Considerable care must be exercised if several plates are developed together in a large tray, the edges are liable to strike together, detaching small chips of glass, which adhere to the soft gelatin surface, and thus cause pin-holes. Keep the plates separated by little strips of wood, tightly fitted to the bottom of your tray.

292. **Temperature of Developer.**—The temperature of developer has considerable influence on its action. As a general rule from 60° to 65° is best. Above this, surface action becomes too rapid, and is therefore apt to produce flatness and fog before the lower layers of film are sufficiently penetrated and acted on to produce the required density and contrast. Very cold developer, on the other hand, gives clear negatives, but they are likely to be insufficiently developed, as cold developers act very slowly, giving the impression that the plate is at fault, and leading one to complain to the plate-maker, which would have been unnecessary had the temperature been raised a little. Temper the developer with a little hot water in winter and a little ice in summer.

293. **Suggestions for the Beginner.**—On developing, pour the developer over the plate by running the graduate along the side of the dish so as to propel a wave of the solution across the plate and avoid patches and streaks caused by quick acting developers when they are not properly applied.

If the dish is not rocked occasionally during development, there will be a mottling all over the film. Pyro is more likely to give this effect than others. There is no remedy; prevention is easy.

Patches of fog may come from fingers or thumb that are contaminated with hypo. Keep every trace of hypo out of the developer and off the plates until after development is complete and the plate rinsed.

294. **Drying the Negatives.**—Plates are best dried in a moderately warm room, the temperature of which should not vary much, with good ventilation. They should not be placed too close together. A plate must never be laid in the sunlight to dry, as this may melt the film, cause transparent holes, and, if nothing worse, will increase the intensity. In cold weather do not allow the negative to get too cold while drying; this not only retards the drying, but in case the moisture therein should freeze, it would cause mottled spots. If the negative is partly dry and then removed to another room which is much warmer or colder, it will cause a difference in the density of the part to dry last. If a negative is wanted in a hurry, it may be quickly dried by laying it for ten minutes (*after thoroughly washing*) in a bath of alcohol, when it will dry rapidly. If dried in this way the negative must first be very thoroughly washed, for if any hypo be left in the film an insoluble white deposit may be formed, which cannot afterwards be removed.

295. If a plate, after being in the hypo, is only rinsed and allowed to stand exposed to the air for some time, it will lose intensity to a considerable degree. After thorough fixing, then thoroughly wash the negative.

296. **Three Good Rules** which will greatly help to insure clean work:

No. 1. Always keep hypo by itself; mix it only in its own dishes, and always wash your hands before touching anything else.

No. 2. Always rinse the tray, no matter what was used in it, as soon as you are through with it; also rinse before use.

No. 3. Keep your workroom clean.

297. **Washing After Development.**—In all cases it is desirable to wash the plate for at least a minute before fixing it.

298. **Under-Exposure.**—An under-exposed plate has usually a lack of detail in the shadows and weakly lighted parts, with too much tendency to density in the strongly lighted portions. To counteract this as much as possible, it is best to remove the plate from the normal developer as soon as its condition is known, and, without washing, place it in a tray of water where no light of any kind can reach it. If this treatment in 2 or 3 minutes brings out the detail of the shadows where there has been but little action of light, it may then be developed in normal developer in a dark place. No plate much under-exposed ever gives a satisfactory result. It is no use to employ a large excess of alkali with the idea of "forcing" out the detail, for such proceedings will only result in fog and stain.

299. Plates or films which are under-exposed will develop slowly, and the developed negative will be thin and transparent in the shadows. If upon developing a plate an image fails to appear, the cause may be attributed to one of five things:

The slide of the holder was not withdrawn.

The shutter failed to open.

The plate was not in the holder.

The developing solution lacked an essential constituent.

The exposure was too short to give even the ghost of an image.

300. **Under-Development.**—This is caused by removing from the developer too soon. The difference between a correctly exposed *under-developed* plate and an under-exposure is, that the entire plate of the former is thin and full of detail, instead of strong in the high-lights and thin in the shadows, as is the case with an under-exposure. The under-developed plate can be improved after fixing and washing by redeveloping, or in other words, by intensifying. (See instructions for Intensifying.)

301. **Over-Exposure.**—An over-exposed plate is flat, wanting in contrast, full of detail but lacking in intensity in the high-lights, or foggy. Where over-exposure has occurred the image appears almost instantly after placing the plate or film in the developing solution, and the entire image develops at the same time—the shadows as fast as the high-lights—there being no contrast, no visible high-lights nor deep shadows. Over-exposure can be overcome, to a certain extent, if, as soon as a negative shows signs of over-exposure, as described above, you add a few drops of bromide of potassium solution to the developer; this will restrain the development. Of course, the negative must be removed from the bath while adding the bromide. Mix the bromide well with the developer, then return the plate again to the developing bath and conclude the development. If a plate is known to be considerably over-exposed, commence with a developer containing a full dose of pyro and some bromide, but very little of the alkali, and then small quantities of the alkali may be added from time to time as the development progresses.

WINTER AFTERNOON

Study No. 6 By K. T. Krantz

302. **Preparing a Bromide Solution.**—Into a bottle pour 9 ozs. of water, and to this add 1 oz. bromide of potassium. Shake until dissolved. With a pocket knife, cut a thin notch the entire length of the cork stopper and insert the cork tightly. When you want to add a few drops of bromide turn the bottle upside down and the notch in the cork stopper will permit the solution to drop, one drop at a time. Any time that a negative flashes up too quickly, indicating over-exposure, a few drops of bromide should at once be added, as the bromide acts as a restrainer and prevents the shadows from developing, thus enabling the highlights to build up and thereby supply the necessary contrast. Negatives that are treated in this way, or rather negatives that are *over-timed* and treated in this way, should be developed farther (thicker) than normal exposures; and after thorough fixing they can be reduced. (See instruction for Reducing.)

303. **Over-Development.** — Over-developed negatives are those which have been left in the developer too long. This may be caused by accident, lack of knowing when the plate is fully developed, or it may be caused by over-exposure where you purposely over-developed in order to obtain detail, snap, and contrast. In any of these cases you can improve the printing quality of the negative by reducing.

304. (See Illustration 31.) Here we illustrate the advantage of reducing strong, thick negatives—plates that would require hours for printing if printing-out paper were used. By reducing, the plate is made to print in a few minutes. Note the contrast between the half of the plate

that has been reduced and that which has not. This illustration should serve to show the advantage of altering negatives improperly developed.

CHAPTER X.

Intensifying and Reducing.

305. **Intensifying.**—The intensifying of a negative is the building up of a negative which is thin and transparent —due to either *over-exposure* or *under-development*—and making it more opaque. Any amount of density can be obtained, and if your first efforts do not produce the desired strength immerse the negative again in the intensifier until the desired density is obtained.

306. (See Illustration 32.) In this illustration we demonstrate the advantage of intensifying thin, flat negatives—those which would give dull, flat prints unless strengthened. In order to demonstrate more clearly the advantage of intensifying, we have intensified only half of the plate, leaving the remainder untouched. Note the difference.

307. **Intensifying Powder.**—For the convenience of the beginner we recommend the use of the prepared intensifying powders or solutions, which can be purchased from any dealer in photographic supplies. Instruction for the use of such prepared powders accompany each package, the usual requirement being to dissolve so much of the powder in so much water, when the solution is ready for use. The bottle containing intensifier should be carefully labeled "Intensifying Stock Solution," and when not in use should be kept well corked and placed away in the dark-room.

308. This solution can be used repeated until completely exhausted. It is advisable to use only a portion of the solution at a time, sufficient to cover the negative completely—3 ozs. is ample for a 4 x 5 plate. After the negatives are intensified the solution should be returned to a bottle labeled "Intensifier for Use," and always use from this bottle. Add enough of the fresh stock solution from time to time to keep the bulk to about 3 ounces, or sufficient to completely cover the plate.

309. **Intensifying the Negative.**—The negative to be intensified must be thoroughly washed, to free it from hypo, before placing in the intensifying solution. Simply place the negative in an empty tray and pour over it sufficient intensifier to fully cover it, and allow it to act until the surface of the film is all of an even color, rocking the tray gently to avoid unevenness and streaks. After the negative has taken on the required density pour the solution back into the bottle labeled "Intensifier for Use;" then wash the negative for about fifteen minutes and place in the rack to dry. Should the beginner desire to compound his own intensifying solutions, we refer him to Chapter V, Volume II.

310. **Reducing.**—Reducing is the treatment of strong, harsh, thick negatives in such a manner as to make them more transparent, thus giving them a better printing quality. Negatives that take hours to print from can be quickly reduced to the correct density for quick printing by use of the reducing powders. These powders, which can be purchased from any dealer, are very convenient for the beginner and are, therefore, recommended. The best time for reducing a negative is when it is taken from the fixing bath. If negatives that are dry are to be reduced they should be first

placed in the fixing bath for a few minutes, then transferred to the reducer until reduced to the desired stage, and afterwards rinsed and washed for fifteen minutes and dried as usual.

311. **Preparing the Solution.**—To prepare a reducing solution, take as much of the reducing powder as is called for in the instructions, and dissolve in the given amount of water. Label the bottle containing the solution "Reducing Stock Solution." With the negative carefully washed, place it in a tray containing a sufficient quantity of the reducer, and leave it in the solution until the density has been reduced to the required extent. This can be judged by lifting the negative out of the tray occasionally and holding it to the light. Keep the tray moving during the action of the reducer, to avoid uneven reduction, streaks, spots, etc. When reduced to the desired stage the plate should be at once rinsed, and then washed for 15 minutes in running water, and dried in the usual way. The reducing can be done in daylight, as the light has no effect upon the negative, and one is better enabled to judge the results. A negative that has been previously washed and dried can be placed into the reducing solution without again washing it. The prepared solution is usually good for only a short time, and should be discarded after use.

312. **Note:** As advanced instruction for reducing, intensifying and altering negatives is given in Volume II, the instruction given herein will suffice to prepare you for more advanced work.

Illustration No. 31
Advantage of Reducing Thick Negatives. Half of Plate Reduced.
See Paragraph No. 304

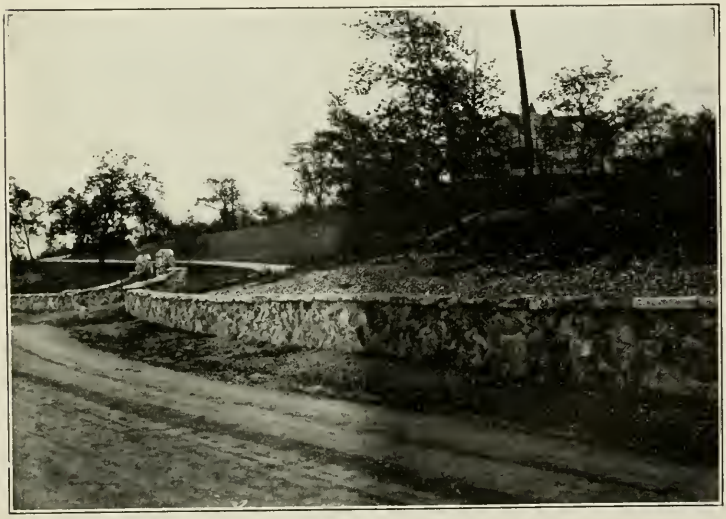


Illustration No. 32
Result of Intensifying Thin, Flat Negatives
See Paragraph No. 306

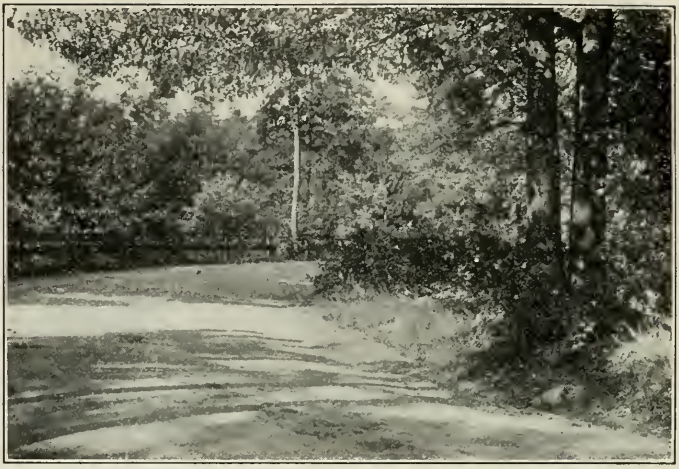


Illustration No. 33
Print from a Correctly Exposed and Developed Negative
See Paragraph No. 315

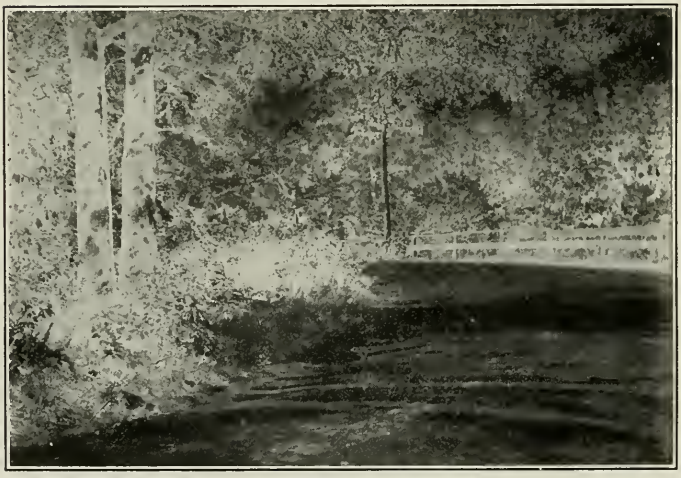


Illustration No. 34
Negative from which Illustration 33 was Printed
See Paragraph No. 315

CHAPTER XI.

Appearance of Negatives With Different Exposures.

313. In order to give a more perfect idea of the appearance of negatives when incorrectly exposed, we have prepared a series of illustrations showing a negative at different stages.

314. **Normal Exposure.**—To illustrate this subject clearly, we have selected a landscape scene, containing not only the extremes of high-lights and shadows, but all of the intermediate tones, and practically every degree of gradation. In this particular picture the road is composed of white limestone, which, in those portions receiving the direct rays of the sun, reproduces perfectly white. The opposite extreme will be found in the shadow of the tree trunks, where there is a trifle detail, yet the negative in this portion is practically clear. The bushes and the small trees on the further side of the fence give any amount of tones; while the shadows cast on the road by the branches of the trees are sufficiently strong to demonstrate the errors which are very likely to occur upon development.

315. In Illustration No. 33 is illustrated the positive print made from a normal negative, and in Illustration No. 34 the negative is shown. Compare these two illustrations—the positive and negative. Both should be studied carefully before proceeding further.

316. The development of this correctly exposed negative, as shown in Illustration No. 34, has been carried just far enough, in that the highest points of light, which are the high-lights on the road and the light from the sky showing through the branches of the trees, have been developed so that they are almost opaque.

317. One great difficulty in working with subjects of this kind is the tendency of the sky (which quickly acts upon the sensitive plate) to become over-developed (hence very opaque) by the time the high-lights of the balance of the picture are carried to the proper stage in development. If the negative has been under-developed (not left in the developing solution long enough) the high-lights will be weak, and the shadows will not contain as much detail as is required.

318. The over-development of normal exposures very seldom increases the amount of detail in the shadows, and in the majority of cases simply tends to cause a fog of the deeper shadows.

319. **Over-Exposure.**—If the negative has been over-exposed, flatness will result, in fact the shadows will be fogged and hazy, as shown in Illustration No. 35.

320. An *under-developed* over-exposure gives a weak, flat negative. To correctly develop an over-exposure the development, unless it can be restrained in time to overcome the flatness, should be carried a trifle further than is required to produce a correctly developed, normally exposed negative. (See Illustration No. 36.)

321. The reason for slightly over-developing an over-exposed negative is to allow for after-manipulation. A nega-

Illustration No. 35
Print from Over-Exposed Though Correctly Developed Negative
See Paragraph No. 319

Illustration No. 36
A Correctly Developed, Over-Exposed Negative
See Paragraph No. 320

Illustration No. 37
Print from Under-Exposed and Correctly Developed Negative
See Paragraph No. 323

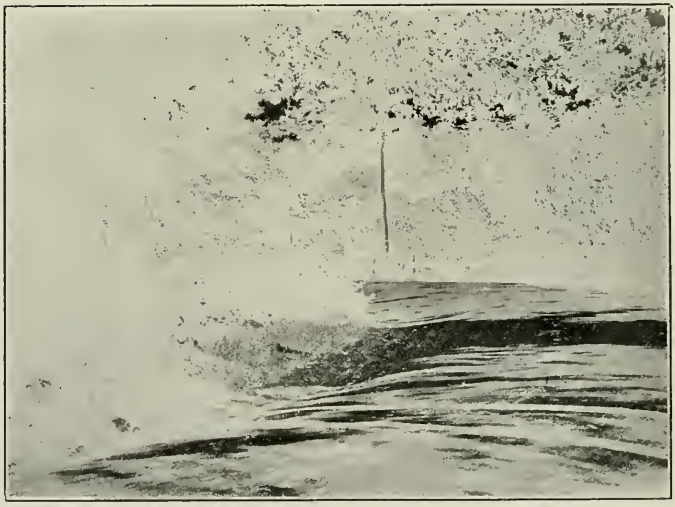


Illustration No. 38
An Under-Exposed, Correctly Developed Negative
See Paragraph No. 324

tive which has been over-exposed and slightly over-developed can be reduced in a reducing solution, which will not only reduce the entire plate but will clear the high-lights and shadows as well, thus giving them snap—resulting in a good printing negative. Therefore, by proceeding to handle an over-exposure in this manner, it is possible to correct the error of over-exposure and secure a negative which very closely resembles the normal negative. The greatest fault with the average worker in handling over-exposed negatives is to under-develop them, as he thinks that the fogging over during the early part of the process of development signifies that sufficient density has been secured.

322. There is, however, a possibility of *over-developing* an over-exposure. When carried to this extreme, the shadows are usually veiled with a heavy fog, and the negative is practically ruined, unless given a vigorous treatment with the proper reducer and afterwards intensified. Whenever possible one should try and restrain an over-exposure during development, and thus avoid the necessity of over-developing.

323. **Under-Exposure.**—If a negative has not been given full exposure, and is not treated for under-exposure in the developing, it will lack detail in the shadows, and the result is extreme contrast. (See Illustration No. 37.)

324. Illustration No. 38 shows a correctly developed, under-exposed negative. While all the detail possible with the exposure given has been retained, yet we have not as much detail as in the correctly exposed negative, as is shown in Ill. No. 34. The development has been carried until the highest points of light are almost as dense as the high-lights in the correctly developed normal exposure.

325. An under-exposed negative should not be carried quite as far in the developer as a correctly exposed one, for if carried too far, or even as far as the *normal negative*, the result will simply be still greater contrast and danger of chemical fog veiling the shadows. Proper manipulation will produce a print as shown in Ill. No. 37. By comparing this print with Ill. No. 33 you will see that there is, however, considerable difference, for Ill. No. 37 is very weak as compared with Ill. No. 33, which latter is strong and brilliant, and has everything to be desired in a good print. But unless the under-exposed plate had been nursed in development the results would have been harsh and worthless.

CHAPTER XII.

Elementary Tank Development.

326. Tank or Stand Development is purely a mechanical procedure. The requirements are merely a tank or liquid-holding receptacle, chemicals, exposed plates, a thermometer and a time-piece.

327. Tank development is based on the principle that an exposed negative will develop to its full density in a developer of a given strength, and with a given temperature. A long series of experiments have proven that the slow development of a negative will bring out greater detail and a longer range of tones than the rapid development, which is generally effected when the tray method is employed. Apart from this the advantages of the tank for the amateur lies in the fact that there is no handling of the plate during development, so that the liability to scratch the film is avoided, and, also, the necessity for examining the plate by a ruby lamp is obviated. This in itself is quite a point, as many of the cheaper kinds of ruby lamps are apt to fog a rapid plate.

328. The simplest form of tank development is that in which an ordinary grooved glass, wood or fibre hypo box is used. Such boxes can be obtained in all sizes, at most dealers in photographic supplies, and, provided they are perfectly clean interiorly—that is, free from all chemicals that will be harmful to the plates during development—such

tanks are fully the equal of the improved metal tanks offered by various manufacturers. These latter metal tanks, however, are designed with reference to their use outside the dark-room, and for a good many this is a distinct advantage. Provided, however, that the amateur has at his disposal a dark-room, the ordinary groove tank first mentioned will make an efficient receptacle for plate development.

329. **Note.**—When using such a simplified form of tank, care must be taken that the plates are lifted up and down in the developer several times when first inserted into the grooves. This is necessary to cause the removal of air-bells, which are liable to adhere to the film and prevent development at those spots. It is also a good plan to agitate the developer in the tank occasionally during development especially if development is prolonged—say over twenty minutes—for if the developer has been standing some time in the tank the active agents are liable to sink to the bottom, creating a denser image on the film in its lower part.

330. **Eastman Plate Tank.**—For the amateur who is not provided with a proper dark-room, or who prefers to do most of his work in the light, the various improved forms of plate tanks are recommended. Of these, the most advanced in its methods of tank construction is the Eastman Plate Tank. This tank consists of a metal solution cup, or tank, with tightly fitting cover; a cage or rack for holding twelve plates, or less, during development and fixing, and a simple block guide for loading the plates into the cage.

331. The tank is manipulated as follows: First, take the plate rack from the tank and attach the loading block to it. See Illustration No. 39. With the block attached, proceed to load the rack by sliding the plate through

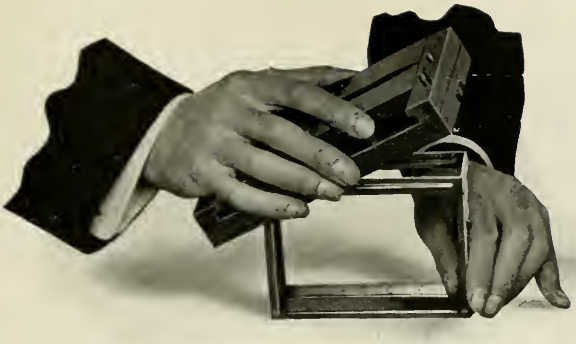


Illustration No. 39.
Attaching Loading Block to Plate Rack.
See Paragraph No. 331.

Illustration No. 40.
Loading Plates Into Rack.
See Paragraph No. 331.

Eastman Plate Tank.

Illustration No. 41.
Lowering Rock of Plates
Into Solution Cup.
See Paragraph No. 331.

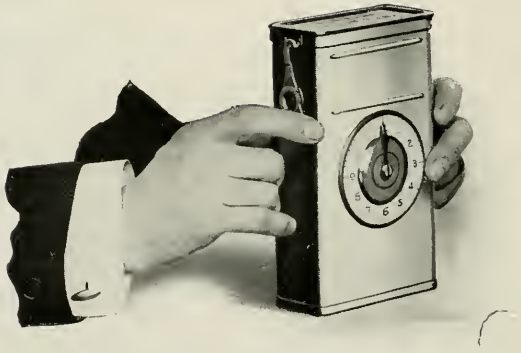


Illustration No. 42.
Fastening Cover of Solution Cup.
See Paragraph 332.

Eastman Plate Tank.

the slot in the block into grooves in the rack. See illustration No. 40. Then move the slotted guide over the next groove and load the next plate, and so on until the plates have been loaded into the plate rack, then remove the loading block. Now fill the tank with the developer and turn the plate rack so that the plates are the long way up, and lower the rack carefully into the solution tank. See Illustration No. 41.

332. As soon as the plates have been lowered into the developer, the rack should be raised up and down a few times by means of the wire rod; this is done to expel air-bells. Then the tank cover is fastened in place and the time is noted, and the hand on the dial on the front of the tank is set to indicate time when development will be completed. See Illustration No. 42.

333. The development is allowed to continue for say fifteen minutes, the entire tank being reversed end for end four or five times during development, as this allows the developer to act evenly over the plate.

334. After development the solution is washed out of the plates by filling the tank several times with fresh water, after which the fixing bath is poured into the tank. The fixing may be carried on in daylight.

335. **Washing.**—The plates, after fixing, should be removed from the rack for final washing. The washing is preferably done in a regular washing tank, or it may be done in trays. When removing the plates from the rack, turn the rack on its side and withdraw the plates. See Illustration No. 43. If plates were inserted with glass sides together and two plates in one groove, they must be separated by

sliding one plate past the other, lengthwise. See Illustration No. 44.

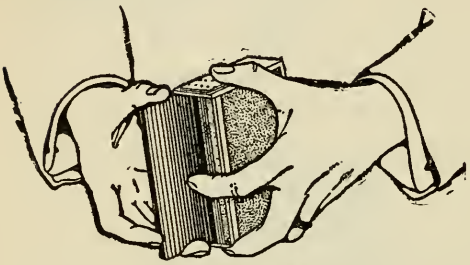


Illustration No. 43.
Removing Plates from Rack.
See Paragraph No. 335.

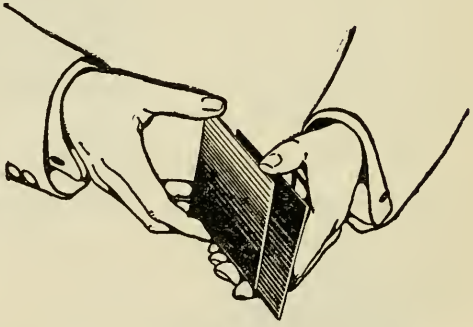


Illustration No. 44.
Separating Plates after Removal from Rack.
See Paragraph No. 335.

336. In Illustrations No. 45 and No. 46 are presented two styles of very simply constructed developing tanks, the *Ingento Automatic Developing Tanks,* fitted with light-tight metal covers. While the loading of these tanks must be done in the dark, yet the developing can be carried on in daylight. The tanks are made for all sizes of plates from 3¼ x 4¼ to 8 x 10. The STYLE "A" tank is made of brass, nickle-plated, and fitted with a removable rack, and can be used for developing, fixing and washing. When the plates are developed

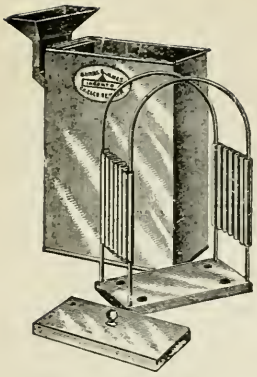


Illustration No. 45.
Ingento Developing Tank.
Style A.
See Paragraph No. 330.

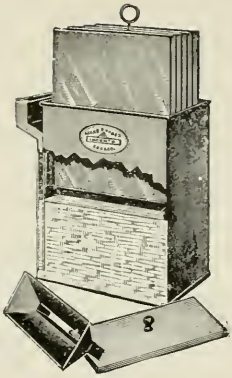


Illustration No. 46.
Ingento Developing Tank.
Style B.
See Paragraph No. 336.

Illustration No. 47.
Ingento Changing Bag.
See Paragraph No. 339.

the developer can be poured off and sufficient hypo solution poured into the tank to cover the negatives. After the plates are fixed the hypo solution can be poured into a jar or vessel and saved for the next batch of plates, and the tank can then be used as a washing box, by allowing the water from the tap to enter through the funnel. In this way the hypo will be thoroughly eliminated from the negatives and tank simultaneously.

337. STYLE "B" tank is more cheaply constructed and is made of zinc, with side walls fitted with long grooves, to receive the plates, and has a patent lifting bottom, by means of which the plates, after developing, may be raised to the top of the tank and removed to the fixing bath without dipping the fingers into the solution. This style tank can be used for developing and washing, but it is not recommended for fixing, as zinc will gradually disintegrate under the action of hypo solution; therefore, where zinc tanks are used an extra fixing tank should be employed.

338. **Loading the Tank With Plates.**—Style "A" tank having a movable grooved rack for holding the plates, the rack should be taken from the tank and loaded by sliding the plates into the grooves, after which the loaded rack is replaced in the tank ready for developing. In style "B" the plates must be loaded in the tank proper, as this style contains no rack, the grooves being built in the side walls of the tank. Where a large number of plates are to be developed two plates may be placed with glass sides together, and both slid into the one groove, thus enabling you to develop double the number of plates that you would if a single plate were placed in each groove.

339. **Ingento Changing Bag.**—Where no dark-room is at hand for loading plate holders or developing tank, the Ingento rubber changing bag will be found very convenient. (See Illustration No. 47.) The plate holders, box of plates, or developing tank, are put in the bag at one end. The bag is then closed with glove fasteners. The hands are inserted through the sleeves (which have rubber wrist-bands), and the plates are changed by aid of the sense of feeling.

340. **Liquid Capacity of Tanks.**—

Size	Empty	With 6 Plates
3¼x4¼	20 ozs.	16 ozs.
3¼x5½	28 "	23 "
4 x5	30 "	24 "
4¼x6½	40 "	32 "
5 x7	50 "	40 "

341. **Developers for Tank Developing.**—Any good developer can be used with the developing tank, providing it is prepared to completely develop in a given time. For the convenience of the consumer different manufacturers have prepared special powders put up expressly for tank developing. The powders are sold in different sized packages, according to the size bath required, and are to be dissolved in a given amount of water, when they are ready for use. Great care must be taken to dissolve every particle of the powder, to prevent spots in the negatives.

342. Bear in mind that the best negatives are obtained from fully-timed plates, and that you should also endeavor to make all your exposures as even as possible, for where the exposures are very near the same the development will be more accurate. Slow development with pyro is preferable to quick development, as the addition of water to a pyro de-

veloper produces finer grained negatives, and the detail and gradation in the highlights and shadows are better.

343. **Pyro Developer No. 2.**—For those who prefer weighing out sufficient chemicals for each batch of developer, we recommend the following bath for 15 minute development:

Pyro	20 grs.
Sulphite of Soda (Anhydrous)	60 grs.
Carbonate of Soda (Anhydrous)	40 grs.

344. Dissolve the chemicals in the order named in 5 or 6 ozs. of luke warm water; then add cold water to make up a bath of 24 ozs. With the temperature of the developer 65° Fahr. the plates will completely develop in 15 minutes.

345. **Filling the Developing Tank.**—Prepare in a large graduate or pitcher the quantity of developer necessary to fill the size tank employed. With the tank loaded with plates, place on the cover, insert the funnel, and pour into the tank the proper amount of developer to completely cover the plates.

346. **Note.**—It is important that the full quantity of developer be contained in one vessel, and the flow into the tank must be continuous without any intermission; otherwise the finished negatives are liable to show streaks where the intermission took place. If a vessel large enough to hold the full quantity of developer cannot be had at the time, it will be necessary to fill the tank with the developer before inserting the plates. You thus avoid streaks. If the latter method is employed it is advisable, when placing the plates in the tank, to slowly raise the negative rack, or plate lifter containing plates, a few times up and down in the solution, *but do not raise them above the solution.* This will remove

any air-bells that may collect on the films. Should they remain unbroken they would cause pin-holes and spots on the finished negative.

347. **Developing.**—Where the developer is poured into the tank after the plates are inserted, as soon as the tank is full of developer note carefully the time at which the development will be completed. Do not disturb the plates until that time has arrived. When the tank is filled with developer *first* and the plates inserted *afterwards*, the time should not be taken until after you have raised and lowered the plates a few times, to remove air-bells.

348. **Temperature.**—It is important in automatic tank development that the temperature of the bath be between 65° and 70° Fahr. It must not be over 70°, for an increased temperature will quicken the developer, and a decreased temperature will retard it. The temperature of the developer should be tested with a thermometer just before the solution is poured into the tank. A change of 5° in temperature may lengthen or shorten the required time for complete development; thus the necessity of knowing the temperature just before you begin to develop.

349. **Fixing Bath.**—The acid fixing bath is recommended for tank development, as it hardens the film, making the plates less liable to damage from handling. The regular prepared acid fixing powder, prepared in packages ready for use, will be found very convenient. All that is required is to dissolve the contents in a given amount of water and place in a jar or vessel ready for use. For those who prepare their own hypo bath we recommend the following:

Water	30 ozs.
Hyposulphite of Soda	8 ozs.
Sulphite of Soda (Anhydrous)	160 grs.

When fully dissolved add the following hardner:

Dissolve in 2 oz. of lukewarm water and then add to bath:

Powdered Alum	¼ oz.
Citric Acid	¼ oz.

Stir well while adding the hardner. This bath should thoroughly fix plates in 15 minutes. The hypo bath may be used continuously, so long as it retains its strength or is not sufficiently discolored to stain the negatives.

350. **Washing.**—One hour's washing in running water is sufficient. After washing the plates may be placed in the drying rack in the usual way. Where plates are developed, fixed and washed back to back in the developing tank, they should be separated and the back thoroughly rinsed before placing in the rack to dry.

351. **Notes.**—The developer must be thoroughly dissolved before using. Undissolved particles will produce spots on the negatives.

The developing tank should be scrupulously clean at the time of developing.

The temperature of the developing solution should never be less than 65°, nor more than 70°.

A thermometer should always be used in testing the temperature; 5° difference in temperature will make a difference in the required time of development.

Do not leave the solution standing in the tank when not in use.

Do not leave exposed plates in a damp tank for any length of time before development.

Should negatives appear dense you will understand that they are over-developed. Should they appear thin you will understand they are under-developed.

CHAPTER XIII.

Photographic Printing.

352. Printing is a method of obtaining, on paper or other material, positive pictures from negatives, which may be either plates or films. The necessary apparatus is a printing frame, in which the sensitive surface of the paper, etc., is pressed into close contact with the face of the negative, and held in that position during the process of printing. The ordinary printing frame consists of a wooden box-shaped frame, having a hinged lid to allow of the examination of the picture during the printing process. (See Illustration No. 48.) Where film negatives are to be printed from, or a smaller negative than the size frame you have at hand, a strong glass is placed in the printing frame, which serves as a support for the small film or glass negative.

353. **Loading the Printing Frame.**—To load the printing frame, remove the hinged lid and place the negative in this frame, gelatin side up. Next, place the fingers of your left hand underneath the printing frame, so as to push one end (the end nearest you) of the negative up above the printing frame. Then, with a camel's hair brush or a piece of soft dry cloth, carefully dust the plate by drawing the cloth or brush over the negative and toward you. This will remove all the dust from the negative and out of the printing frame. If you dust the plate without raising

it above the printing frame, it will simply remove the dust from parts of the plate, but not from the printing frame, and it might work back on the negative again. These little particles of dust, if allowed to remain on the negative or in the printing frame, will cause white specks on the print. Never attempt to remove the dust by blowing on the negative, as saliva is liable to be blown on the film, and the least bit of moisture would cause the paper to stick to the negative. (See Illustration No. 49.)

354. When ready to print, place the sensitized paper on the negative, the emulsion side coming in contact with the film. (See Illustration No. 50.) Then place the back of the printing frame in position, press down the springs and fasten tight. The printing frame is now loaded and ready for printing. Place the printing frame in strong daylight. (See Illustration No. 51.) If you have carefully cleaned the glass side of the negative, you can place it in direct sunlight. The effect of the light coming through the negative to the sensitive paper will be to gradually print the image from the negative onto the paper. The thin or transparent parts of the negative print first and change the paper from white to a dark color, thus producing the image.

355. **Blue Print Paper.**—The simplest of all processes for making prints is undoubtedly that known as the Ferro-Prussiate, or Blue Print process, in which, as the name indicates, the pictures are a bright blue. There are many different brands of this paper on the market and they can be purchased at any photographic supply house. While the instructions which are sent out by the manufacturers are generally found to give good satisfaction, we deem it advisable to give the following short instruction.

Illustration No. 48
Printing Frame
See Paragraph No. 352

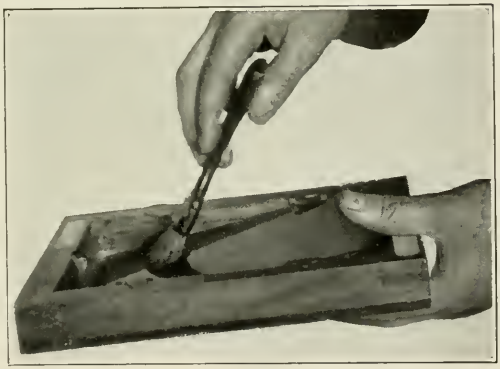


Illustration No. 49
Dusting Plate in Printing Frame
See Paragraph No. 353

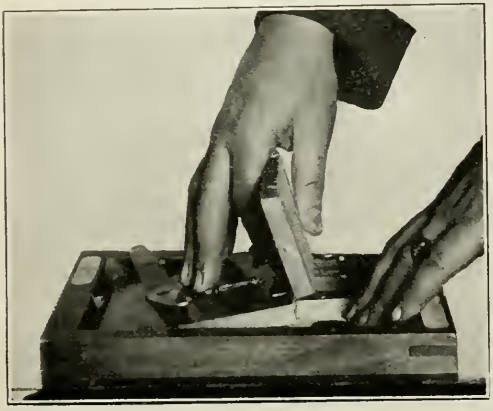


Illustration No. 50
Loading Printing Frame
See Paragraph No. 354

Illustration No. 51
Printing Frame in Position
See Paragraph No. 354

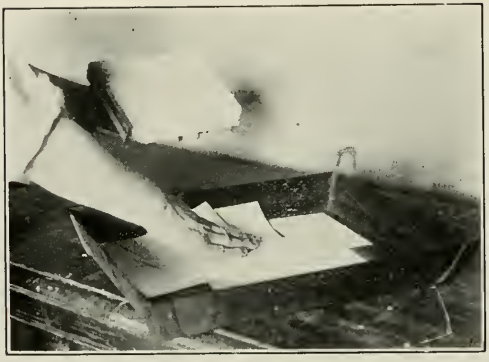


Illustration No. 54
Sliding Prints From Box Cover into Toning Bath
See Paragraph No. 391

356. **Depth of Printing.**—You will find that while this paper prints fairly rapidly, it is best to make your prints in strong sunlight. The paper is placed in position on the negative in the ordinary way, the yellow side coming in contact with the film of the negative. When the shadows take on an olive green appearance, a bronzing as it were, the image is printed dark enough. A little experimenting will soon teach you the proper depth of printing.

357. **Developing.**—Place in a clean tray sufficient water to almost fill it. Place your prints into this clean water, allowing them to remain for a few minutes. Then give them a number of changes until the last water shows no discoloration; about 15 minutes of washing will be sufficient. If the water is hard, it is advisable to add a little hydrochloric acid to the wash waters. The prints may also be developed by holding directly under a tap and allowing the water to run on them until the draining exhausts the coloring, when the prints will be developed. It is not advisable to wash the prints longer than is absolutely necessary, as long washing is apt to cause them to become flat and lose all brilliancy.

358. **Drying Prints.**—Place your prints face down on a clean white, chemically pure, photographic blotter. Place another blotter over the prints, then rub your hand or roller over this blotter, so as to absorb the excessive moisture in the prints. Next place your prints between two perfectly dry blotters and allow them to remain until dry.

359. **Toning Blue Prints.**—For those who care to tone their prints the following formula will enable them to produce excellent black tones. After the print has been developed and washed, place it for a few minutes in a bath

of water, which has been made slightly acid by adding a few drops of nitric acid. After this bath immerse the prints in the following solution:

Carbonate of Soda	½ ounce
Water	12 ounces

360. Allow them to remain until the image disappears and reappears again with an orange tone. They should then be placed in the following bath:

Gallic Acid	½ ounce
Water	12 ounces

Leave the print in this bath until the desired tone is obtained, which usually requires from eight to ten minutes.

361. **Converting Blue Prints Into Brown Prints.**— If you have blue prints which you desire to convert into a brown tone, the following method will be found very satisfactory. The blue prints should be thoroughly washed and dried, and then quickly plunged into the following solution:

Strong Ammonia	1 ounce
Pure Water	8 ounces

362. Leave the print in this solution until it has nearly lost all of its color, which will take from two to four minutes. Rinse the print and again plunge it into a bath of tannic acid prepared as follows:

Tannic Acid	½ ounce
Pure Water	25 ounces

363. Leave the print in this bath until the desired clearness and tone are obtained, which will usually require about ten minutes. When the color is not dark enough it may be intensified by adding to this bath a few drops of ammonia. After a couple of minutes rinse the print thoroughly in water, and dry.

364. **Practice Work.**—Making blue prints, especially where you buy the paper already sensitized, is a very simple process, as the paper is printed in bright sunlight and is developed by merely washing in water. The principal interest in this process lies in the sensitizing of your own paper, as the sensitizing bath may be applied to fabrics, or any other surface, and prints made just the same as upon paper. See following chapter.

365. As this process is quite simple, you will experience little or no trouble. Be sure and print in the sun. The appearance of the print during printing is faint and mealy, similar to a platinum. Print until all outline is visible. A few experiments will enable you to judge the proper depth. It is advisable to note on the back of the prints of your first efforts, all the data connected with the experiments, which file for future reference.

CHAPTER XIV.

Blue Print (Ferro-Prussiate) Sensitizing—Paper, Cloth, Silk, Etc.

366. While instructions for using this paper already sensitized, ready for use, will be found in the previous paragraphs, the following formula for preparing your own paper may be employed. This same sensitizing solution can be applied to a number of other surfaces, such as cloth, silk, post cards, etc.

367. **Formula for Sensitizing Solution.—**

STOCK SOLUTION NO. 1.

Water	8 ozs.
Citrate of Iron and Ammonia	1⅞ ozs.

STOCK SOLUTION NO. 2.

Ferricyanide of Potassium	1¼ ozs.
Water	8 ozs.

368. The Ferricyanide should be in clear, bright ruby crystals, and it is always well to rinse them in plain water before final dissolving, as almost all of these crystals have a slight brown coating on them and it is best to remove this. Place in a bottle and mark it Solution No. 2.

369. When the solutions are dissolved keep them in a dark place. If you do this they will keep for a long time; in fact, the bath will work better after standing for at least one week.

370. **Sensitizing the Paper.**—The best paper to use is the plain Rives paper, which can be purchased at any

photographic stock house. Mix equal parts of No. 1 and No. 2 solutions and with a brush apply to the paper; or if you desire, float the paper on the solution. For the beginner we advise the cutting of a sheet of paper into small sheets, especially if you intend to float it. Place the solution in the tray (this tray should be used for nothing else but this sensitizing solution). Catch the sheet of paper at two corners, between the fore finger and thumb of both hands, and then lower it onto the solution, having the center of the sheet touch first, and then slowly lower the rest of the paper over the solution, being careful that you float the paper and get none of the solution on the back. (See Illus. No. 52.) As soon as the sheet is on the bath, raise the paper from one corner and gently remove any air-bells that may have gathered. (See Illus. No. 53.) Allow the paper to float for about three minutes, after which hang up to dry. The paper must be dried in the dark, and when dry it can be rolled up and placed in a light-tight box, or cupboard.

371. When sensitizing post cards it is advisable to do it with a brush, applying the sensitizer only to the parts of the post card on which you are going to print. Occasionally you will find that the prints look foggy, that is to say, it is impossible for you to obtain clear whites. It is then advisable to add one-half grain of potassium bicarbonate to the above sensitizer. When sensitizing post cards they should be dried as rapidly as possible. It is advisable to do this sensitizing in artificial light.

372. An excellent bath, which gives a very sensitive and quick printing paper, is made according to the following formula:

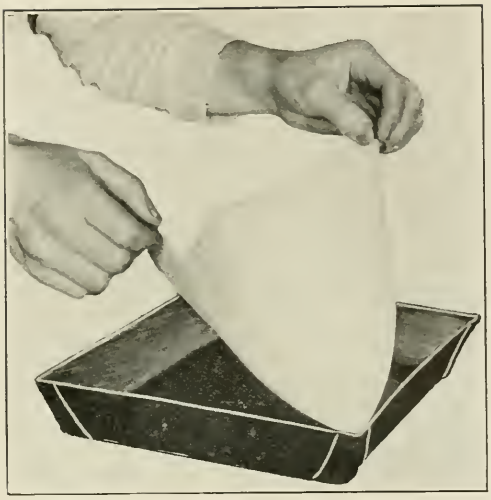


Illustration No. 52
Sensitizing the Paper—Lowering onto the Bath
See Paragraph No. 370

Illustration No. 53
Sensitizing the Paper—Removing Air-bells
See Paragraph No. 370

(a) Ferric Ammonium Citrate (green)*...110 grains
Water ..... 1 ounce
(b) Potassium Ferricyanide ..... 40 grains
Water ..... 1 ounce

Mix in equal parts; keep in the dark, and filter just before use.

*If the ordinary brown citrate is used, the formula should contain 80 grains, and the ferricyanide should be increased to 60 grains. This solution is applied to the paper in exactly the same manner as the first formula given.

373. **Sepia Paper.**—A sensitizing solution which will give a sepia paper is made according to the following formula:

(a) Ferric Ammonium Citrate (green)....110 grains
Water ..... 1 ounce
(b) Tartaric Acid ..... 18 grains
Water ..... 1 ounce
(c) Silver Nitrate ..... 45 grains
Water ..... 1 ounce
(d) Gelatin ..... 30 grains
Water ..... 1 ounce

374. Solution *d* should be rendered just fluid in a water bath, *a* and *b* added, and lastly *c*, a few drops at a time. Printing is carried the same depth as for the regular blue print, and the prints then fixed in a solution of hypo—1 part hypo and 50 parts water. After fixing they should be washed for not less than 20 minutes, then dried.

CHAPTER XV.

Gelatin Printing-Out Paper.

375. **Printing and Toning Gelatin Printing-Out Papers.**—The following instruction covers the simplest method of finishing prints made on gelatin printing-out paper, the prints being toned and fixed in a combined bath. By a combined bath we mean a bath in which the toning and fixing have been combined into one operation.

376. **Printing on Gelatin Printing-Out Paper.**—The length of time required to completely print the image varies according to the strength of the light and the density of negative, and ranges from five to thirty minutes. The image on the paper will be of a dark red color, and printing will be completed when the high-lights or white portions are slightly tinted—no attention should be paid to the shadows as they will be cared for in the toning. When at this stage the print should then be removed from the frame and placed in a box, excluding the daylight. Should the print, after removal from the frame, be exposed to the daylight, the high-lights or lightest portions will gradually change to the color of the densest shadows. You must, therefore, guard against exposing the print to strong light after printing, before or while toning.

377. Different kinds of negatives require different depths of printing. For example, a dense negative, or in other words, a slow printing one, will print slower, but will

print deeper, than a soft or quick printing negative. From the fact that a dense or hard negative prints slowly, it gives a more solid print than a thin negative. Because of the great density of the plate the high-lights are restrained from printing until the shadows have been exposed for a considerable length of time to the strong light, and have penetrated deeper into the emulsion of the paper.

378. By the time the high-lights are properly printed the shadows will be printed very deep, but will not lose any of the detail in the toning. Therefore, a dense negative (one which is contrasty and a slow printer) should not be printed as deep as a soft or thin one. With a hard negative, print one-half shade deeper than you desire the finished picture.

379. It is different with a soft or quick printing negative. A quick printing negative prints on the surface only, unless exposed and printed in the shade, instead of in bright sunlight. In fact, it is advisable to print thin negatives in the shade to get the best results. Even then they should be printed darker than a slow printing one. In other words, with a weak negative (one that is very thin and transparent, but full of detail), we advise carrying the printing one or two shades deeper than is required for the finished picture, as the slower the reduction of silver in printing the stronger will be the finished print. The toning and fixing being combined will cause the prints to grow only a little lighter during the process, as prints are not previously washed, which washing would reduce the strength of the print before toning and necessitate deeper printing.

380. The slower you print from a thin negative the better. By that we mean that they should be printed in the

shade. If necessary to print in direct sunlight, cover the printing frame with one or two thicknesses of very fine tissue paper. French tissue paper, sometimes called onion skin, should be used. In ordinary tissue paper there are many little holes in the texture, which would leave black spots on the prints. The proper tissue paper will filter the light, causing it to print more slowly, but much more evenly, and when used over a thin negative the prints will be a great deal stronger.

381. **Toning.**—Sometimes prints toned in the combined bath are not permanent. There are also times when some prints of a batch are permanent and others fade quickly. This is generally caused by the printer over-working the combined bath; i. e., he has toned more prints than the quantity of bath will stand. The combined bath contains a certain amount of gold, which will tone a given number of prints. As the gold deposit gives the permanent tone, when this gold is exhausted there then remains only the lead and hypo, which will produce a so-called lead-hypo tone that is not permanent. The bath also contains a limited amount of hypo, sufficient to balance the amount of gold, and will only fix a certain number of prints. Fixing is a dissolving and eliminating of the unchanged silver in the prints, thus making them permanent. Therefore, if more prints are toned and fixed in the bath than the amount of gold and hypo is able to tone and fix, the prints will be neither toned nor fixed, and, consequently, not permanent.

382. THE TEMPERATURE should never be higher than 50° Fahr., both winter and summer. If the temperature is higher than 50° you are apt to produce sulphurization, and sulphurization will cause the prints (although the tone may be pleasing) to fade very rapidly.

383. For the beginner we advise the use of prepared toning powders or solutions. These powders or solutions are generally put up in concentrated strengths, requiring the addition of so much water before use. It is generally best to allow all toning baths to stand for twelve hours, to ripen before using.

384. A good plan is to prepare the bath the day before it is wanted. After the beginner becomes accustomed to the use of the prepared powders he can prepare his own combined toning bath according to the formula given below.

COMBINED TONING BATH.

STOCK SOLUTION A.

Hyposulphite of Soda	8 ozs.
Alum (Crystals)	6 ozs.
Sugar (Granulated)	2 ozs.
Water	80 ozs.

385. Dissolve the hypo in the 80 ozs. of water first; then add and dissolve the balance of the chemicals, one at a time, in the order they are given. When these are all dissolved add to the above

Borax	2 ozs.

dissolved in

Hot Water	8 ozs.

The Stock Solution A should be prepared in a large glass jar, or small stone crock, and kept covered, free from dust. Let this solution stand over night, and for use decant the clear liquid.

STOCK SOLUTION B.

Chloride of Gold	15 grs.
Acetate of Lead (Sugar of Lead)	128 grs.
Water	15 ozs.

THE EFFORT

Study No. 7—See Page 370

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386. Chloride of gold can be purchased in 15-grain tubes. Make of this a liquid stock solution, by placing the chloride of gold in a 16-ounce bottle, adding the acetate of lead, and then dissolving these two chemicals in 15 ozs. of water. This solution will then contain one grain of gold to every ounce of solution.

Note.—Solution B should be shaken up before using, and *not* filtered.

To tone fifteen cabinets, or their equivalent, take,

Stock Solution A	8 ozs.
Stock Solution B	1 oz.

Place the prints in the above without previous washing. Tone to the desired color, and then immerse the prints for five minutes in the following salt solution, to stop the toning:

Salt	1 oz.
Water	32 ozs.

387. An extra fixing bath should be used to insure thorough fixing. After the salt bath, give three changes of cold water, and then fix for ten minutes in the extra fixing bath, composed of

Hyposulphite of Soda	1 oz.
Sulphite of Soda (Crystals)	60 grs.
Borax	¼ oz.
Water	20 ozs.

388. Wash one hour in running cold water, or in sixteen changes of cold water, when prints are ready for mounting. The combined bath must be used cold—not over 50° to 55° Fahr. If the bath is too warm it will cause yellow prints, with a greenish cast in the half-tones. *The combined bath is an acid solution. The borax neutralizes only the excess of acid in the alum. Any attempt to neutralize the bath would precipitate the alum. The combined bath should not be used the second time.*

389. As all prints toned in combined bath dry down one shade darker in tone, you must allow for this and remove the print from the bath one shade warmer than you would like the finished print. It is advisable to keep the bath below 55° Fahr. during toning, and when it is not in use

keep it in a cool place. In order to keep the bath at the proper temperature, provide yourself with an all-glass dairy or bath thermometer, which is inexpensive, and by keeping it in the bath constantly, while toning, you can regulate the temperature of the bath at all times. If it is impossible to obtain an all-glass thermometer you can use one on an aluminum frame, or even an ordinary thermometer attached to a wooden frame, provided the glass is fastened in without nails or anything of iron, as iron will ruin a toning bath.

390. In summer fill a tray, which should be a few inches larger than the toning tray, with broken ice. In this place the toning tray, which must be of glass, porcelain or enamel lined. (A metal tray would destroy the toning bath, causing it to turn black; the prints would have iron rust spots on the surface, and the bath containing prints would not tone at all.) Pour the toning bath into the tray, place the thermometer in the bath, and when it registers 55° Fahr. you are then ready to commence toning. The warmth of the hands will keep the bath at about 55° Fahr. Should it become too cold, lift the tray from the ice for a few minutes, placing it on a table, and the temperature of the bath will rise very rapidly. It is better to have the bath too cold than too warm.

391. When your prints are made and your bath is ready for toning, in order to avoid spots caused by perspiration rinse your hands in a weak solution of carbonate of soda, after which wash and dry thoroughly. Then place prints for toning on a cardboard box cover (a trifle larger than the prints to tone). Hold this cover in the palm of your left hand and tear off one side of the cover. Then, with the right hand, slide the prints face down, one at a

time, into the toning bath, being careful to cover the entire print with the toning solution. (See Illustration No. 54.) When you have in this manner placed one-half dozen prints in the bath, turn them face up, and with the finger tips of your right hand remove the little bubbles or air-bells that may have gathered on the face of the prints. These air-bells, if not removed, will leave black or yellow spots. After removing them, turn the prints face down and place half a dozen more prints in the bath. Proceed with these as with the former six, being careful to remove the air-bells. The twelve prints will be enough to handle until you become accustomed to the toning.

392. As the prints lie *face down,* draw out the bottom print and transfer it to the top, turning it *face up.* Repeat this operation until each of the prints, in turn, have been brought from the bottom to the top and turned face up. Then start again with the bottom print, transferring it to the top and turning it face down. Keep this up as long as the prints are in the bath, the object being to keep them *constantly in motion* while toning. By turning them, first face up and then face down, you will always know which print was moved last, and thus *make sure that each one receives its proper share of handling.* Continue this until the desired tone is obtained, say twenty minutes. If your bath becomes warm the prints will tone much faster, but the tone will not be permanent. Therefore, you must watch and not allow the temperature of the bath to go above 55° Fahr.

393. CAUTION—**Toning.**—If prints are allowed to lie in the tray, without being constantly separated and moved about, they will tone unevenly and disagreeable streaks or spots will appear, completely ruining the prints.

394. While, as just stated, about twenty minutes will be required to properly tone and fix a print, you should not judge the progress of toning by timing, but entirely by watching the appearance of each print. When first put into the bath it turns a disagreeable yellow, but as the toning progresses it slowly improves in color, growing darker, more on the brown or sepia tone, and the white parts (the high-lights) become clearer and whiter.

395. As soon as a print has the desired tone, place it in a tray or dish containing plenty of fresh, clean water. Leave it there, face down, until all the remaining prints are toned. If, however, you have many prints to tone, they should be handled over in the fresh water several times after toning, to avoid the staining that is apt to occur if the prints lay packed for any length of time before a final washing.

396. **After-Fixing Bath.**—To insure thorough fixing, which is absolutely necessary if you want your prints to be permanent, they should be placed in the after fixing bath prepared according to the formula given. Before immersing in this *after-fixing bath,* give the prints three changes of fresh water, and between each change of water pick them over just as you did in toning, so as to thoroughly separate them, and wash off any sediment left on the prints from the combined toning bath. Then place the prints in the above weak hypo bath for ten minutes. This bath can be used until you have fixed fifty 4 x 5 prints, or their equivalent, when it should be discarded and a fresh *after-fixing bath* made up.

397. CAUTION—**Washing.**—The washing of the prints, removes the sediment of the *combined toning bath* still on the

prints. If you carry this sediment into the after-fixing bath you will have a weak toning bath, which would act upon the prints and very likely spoil them. After fixing in this weak hypo, place the prints in fresh water and give them ten changes in about an hour's time, carefully picking the prints over and over between each change of water. If the prints are not picked over and over (even in running water) they are apt to sink to the bottom of the tray and mat—stick together—and then the toning and fixing chemicals would not be eliminated from the prints. This changing of water and keeping the prints constantly in motion is very important. If not done properly the prints will not be thoroughly washed, and as a result will soon fade and discolor. After washing, the prints are ready for mounting.

398. **Squeegee.**—In case you do not wish to mount the prints, dry them flat, by squeegeeing them onto a ferrotype plate. Ferrotype plates are tin plates, Japanned, which can be purchased at any photographic supply house. To squeegee a print, first clean the plate with clean water, and then, before placing the prints in contact, swab the plate with the following solution, rubbing dry with a clean rag or cotton:

Benzin	1 ounce
Paraffin	10 grains

399. Next place the print in contact, face down, and squeegee by covering it with a dry blotter and rolling thoroughly with a print roller, to expel all air-bells. Then allow it to dry. When bone dry the print will drop off, or can be removed easily by raising one corner with a pen-knife. Should the prints stick, the plate has not been properly prepared and they must be soaked off carefully in water and the plate gone over again, before using a second time, with the

paraffin solution; but with care you will have no trouble on this score. Usually, where new squeegee plates are employed they can be used for some time without paraffining. Should the prints at any time stick to the plate, you can apply the paraffin and overcome this difficulty.

400. **Mounting Glossy Prints.** — Squeegeed glossy prints can be mounted after squeegeeing, if they are prepared in the following manner: With your prints squeegeed onto the ferrotype plate and the surface moisture dried out, apply a good heavy paste to the back of the prints (which are still firmly held to the ferrotype plate). We recommend Higgins' prepared paste for this purpose, or you can prepare your own paste according to the following formula:

401. **Formula for Making Paste.—**

In some earthen dish or even in an ordinary tin cup, place a tablespoon full of common gloss starch; add to this half a cup of water. Stir the starch until dissolved, then place on the stove to cook, stirring continuously until it commences to thicken; then remove from the stove, and keep on stirring until all lumps are removed and the paste is smooth. Set it to one side to cool, after which strain through ordinary cheesecloth. The tablespoonful of starch will make enough paste for fifty to seventy-five 4 x 5 prints.

402. **Note.**—Should you stir the paste too long after all lumps are removed the paste will become blue and transparent, which is not as good as when it is pure white. Apply the paste with an ordinary paste brush.

403. The paste will dry good and firm as the print dries out, and although the print will dry a little slower, the paste will be found to adhere well when rewet. This will not interfere with the handling of prints unmounted, and they can be kept as long as desired. Then when you mount them you can do so in two ways. First, by thoroughly dampening that part of the card on which you are going to mount and laying your print on the card in the proper manner and

weighting it down—of course always being sure to put a piece of plain paper over the glossy surface of the print before you lay another card on top. This weight will press the print firmly on the card and the moisture on the latter will dampen the paste sufficiently to make it adhere firmly.

404. Secondly, you can wet the back of the print with a damp sponge—only wetting it sufficiently to make the paste soft. Then, by laying the print on the card and weighting, as stated above, it will take a very firm hold. Or, you can adopt both methods, slightly wetting the back of the print and the face of the card also. A good squeegee roller is necessary in mounting dry-prints, which previously have been pasted while on the ferrotype plates. Press them into place very firmly on the cards. There is no danger of impairing the gloss on the print, providing you do not touch the surface with your wet fingers, or allow any water to get to it.

405. The Eastman Kodak Co. supply a dry mounting tissue, which is placed between the print and card, and by a few seconds' pressure with a hot iron the print is mounted. Complete instructions for use accompany each package of tissue.

CHAPTER XVI.

Printing and Toning—Difficulties.

406. **Depth of Printing.**—Only practice and close observation can teach you this. With the combined bath, where both the toning and the fixing are done in one operation, the prints should be printed only a trifle darker than the tone you desire for the finished picture. Before removing prints from the frame, impress upon your memory the depth of each print, and if you find, after toning, that they are too dark or too light, govern yourself accordingly the next time you are printing. With a little practice you will be able to judge the proper depth.

407. **Bath Too Warm.**—Allow your tray containing the toning and fixing bath to remain on the ice, or you can add a small piece of ice to the bath until it is of the proper temperature. If you have no ice, allow running water to flow into the outside tray. If this water is of the proper temperature the bath will soon become the same temperature.

408. **Bath Too Cold.**—When the toning bath is too cold, remove it from the pan of ice until it assumes the proper temperature. At all times keep your thermometer in the toning bath and watch it closely.

409. **Bath Tones Too Fast.**—This is generally caused by the bath having become too warm. It hastens the action of the chemicals and the print will tone before it is fixed. It is also apt to produce sulphurization, and although the prints may have a pleasing tone, they are not permanent and will fade in time. If more gold has been added to the bath than the formula calls for, it will tone too fast.

410. **Bath Toning Too Slow.**—If the toning bath becomes too cold the action of the chemicals will be slow, and naturally it will tone slowly. It is advisable, however, to have the bath tone rather slow than too fast, because slow toning insures perfect fixing and the prints are more liable to be permanent.

411. **Bleaching of Prints in Toning Bath.**—Bleaching of prints generally occurs when a toning bath has been used too long,

or when too many prints have been toned in it. The bath then becomes over-charged with silver from the prints and produces green tones, with the whites very badly bleached. Never tone more prints in a given amount of toning solution than called for in the instructions.

412. **Bleaching of Prints in After-fixing Bath.**—If the prints have not been thoroughly washed to remove the toning solution, you are apt to carry some of the toning bath into the after-fixing bath; this would make of it a very weak toning bath and the prints, on account of the excess of hypo, would not only continue to tone, but would be apt to bleach.

413. **Unable to Secure Blue-black Tone.**—The combined bath is not adapted and is not intended for producing blue-black tones. If the negative from which you are printing is a strong negative, you can produce a purple tone, clear half-tones and highlights, and warm shadows, but the combined bath is only intended for warm tones.

414. **Toning Bath Becoming Discolored When First Prepared.**—This will only occur if the toning bath has been made up in a tin, or in any metal dish. Whenever a metal dish is used a chemical action sets in, more especially in tin, which will discolor the toning bath and make it useless. Moral—never use metal trays for any purpose in photography.

415. **Milky Color of Bath After Toning a Number of Prints.**—The bath will become somewhat milky with use, which does no harm if its chemical strength is not exhausted. After a number of prints have been toned and the bath is allowed to stand, it will discolor as the light acts on the silver released from the prints. As long as the prints are clear and crisp it matters little; if the prints look muddy, use a fresh bath.

416. **Uneven Tones.**—The prints will tone unevenly if they are not handled over and over during toning. Follow the instruction and you will have no trouble with uneven tones.

417. **Straight Lines on Toned Prints.**—This will only occur when the prints are allowed to lie in the baths without picking them over. Gelatin prints, when wet, will sink to the bottom of the tray and stick together. Where one print laps over the other the silver in the print oozes out of the edge of the print and leaves a mark.

418. **Weak Prints.**—If the toning bath is too cold, or the prints are not printed dark enough, the result will be weak prints.

419. **Prints Tone in After-fixing Bath.**—This can occur where a certain amount of toning bath has been carried into the fixing bath with the prints. Wash thoroughly before placing in the after-fixing bath.

420. **Softening of Prints While Washing or Toning.**—This is generally caused when the toning bath becomes too warm. Carefully watch the temperature of the bath. If the rinsing waters are too warm they soften the prints. At the slightest sign of softening of the prints, prepare a very weak solution of alum, as follows: To one-half ounce of saturated solution of alum add sixteen ounces of water. Of this solution add just a little to the water and it will harden the surface of the prints. Thoroughly wash the prints after applying the alum bath, to eliminate all the alum.

421. **Prints Continue to Tone in Water Previous to After-fixing Bath.**—If you are not using enough water in your tray the toning bath which you are carrying with your prints into this water will cause it to become a weak toning bath and the prints will continue to tone. If you are toning very many prints change the water occasionally, thus eliminating all the toning solution.

422. **Small Brown and Black Spots.**—These are caused by air-bells gathering on the prints. They prevent the toning solution from coming in contact with the print and cause sulphurization, a gas being formed under the air-bell. Carefully remove all air-bells when the print is first placed in the toning bath. They will gather on the back as well as on the face of prints, and it is advisable to remove these also, as they are apt to cause air-bells on the surface of other prints.

423. **Yellow Stains.**—These are generally caused by dirty dishes, by prints matting together, by the chemicals not having thoroughly dissolved, or by too warm a toning bath

Ferrotyping Prints—Difficulties.

424. **Sticking of Prints to Ferrotype Plates.**—If the ferrotype plate has not been thoroughly cleaned and you fail to use the solution given in the instructions, the prints are apt to stick. If ferrotype plates are used for a long time, they become old and lose their non-adhesive surface, and prints will stick to them. Carefully clean your ferrotype plate and apply the paraffin according to instructions, and you will have no trouble.

425. **Dull Spots on Prints When Ferrotyped.**—When the print does not come in perfect contact with the ferrotype plate, air-

bells will gather between the print and the plate. Wherever there is an air-bell there will be little or no gloss. Squeegee your print in perfect contact with the plate and you will readily overcome this difficulty.

426. **Pebble-Like Spots on Print When Ferrotyped.**—These little spots, which generally appear about the size of a pin-head, are usually caused by particles of dirt in the water. These particles prevent the print from coming in perfect contact with the ferrotype plate and, therefore, cause these pebble-like spots. As these spots will show through on the back of the print, raise it, remove the dirt, and then squeegee it again, bringing the print in perfect contact with the plate. If necessary, filter the water and you will avoid further trouble.

427. **Perfect Contact Between Print and Ferrotype Plate.**—When you place your ferrotype plate on the table or bench see that the latter is perfectly smooth, and that nothing is under the plate, so that when you place your print on it the squeegee will pass over perfectly even. It may take a little elbow grease to remove all air-bells, but keep at it until they are removed and you bring the print in perfect contact with the plate.

428. **Ferrotyped Prints Lose Gloss Upon Mounting.**—This can only happen if you allow moisture to reach the surface of the print—damp blotters or damp fingers would cause it. Be careful that only dry blotters are used and that you dampen the previously pasted print, or the mount, just enough to make the prints stick.

CHAPTER XVII.

Developing or "Gaslight" Papers—Regular Grades.

429. Quite unsimilar to the papers described in the previous chapters are the so-called developing or gaslight papers. The first name is given to these papers because the image has to be developed on the paper in the same way as on a plate or film, there being no visible image after printing. They are called *gaslight*, first because the paper may be printed by gaslight or artificial light and, second because these papers, being of considerable less speed than a dry plate, do not require the use of a dark-room in order to develop the image, but can be worked in a room lighted with gas or other artificial light, without affecting the image. As these papers are very much more sensitive to light than printing-out papers, they must be kept in light-tight boxes or packages; and the placing of the paper on a negative to be printed from must be done in subdued artificial light.

430. With gaslight paper, the photographer who is making pictures whether for pleasure or for profit, and who may be following his usual vocation during the day and spending his evenings and spare moments only at this pleasant and profitable profession, is enabled to make prints by oil, gas or electric light. There is no waiting for sunshine, which is the case when making prints on a printing-out paper.

431. There are many brands of developing papers. The most popular are the Velox, Azo, Argo, Cyko and Artura.

Each brand is made in at least two grades, *regular* and *special.*

432. All manufacturers place their products on the market, in cut sheets to suit the different sized plates or films used. There are twelve sheets to the smallest package, although the paper is put up in two dozen, half gross and gross packages, as well.

433. To meet the requirements of the printing qualities of all kinds of negatives, gaslight papers are manufactured in various grades of paper and emulsion, but in this instruction we will only treat with the regular grades. The special grades are dealt with in the advanced instruction on printing, Vol. II.

434. **Developing Powders.**—There are many prepared developing powders which can be procured, and each manufacturer claims that his brand is the best for his particular paper. There is a certain amount of truth in this; yet, with the exception of a slight difference in the proportion of the various ingredients, all developers are practically the same. All contain a developing agent, such as metol, ortol, hydroquinon, etc., also sulphite of soda, either potassium or sodium carbonate, and bromide of potassium.

435. The developing powders should be dissolved in a given amount of water and then placed in a bottle, corked and labeled. When ready to develop, pour from the bottle enough of the developer to fully cover the print. The used developer should be saved and poured into a separate bottle. A little fresh stock solution added to the old bath the next time you are developing makes it as good as new.

436. The beginner can make no mistake in using these prepared developing powders, but he must carefully mix ac-

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By Geo. H. Scheer, M. D.

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cording to the manufacturer's instructions printed on the package.

437. **Fixing Bath.**—After a print is developed it is only partly completed, for it is yet sensitive to light. All sensitive salts that have not been affected by either light or developer must be removed before allowing a strong light to fall on the print. This is accomplished by immersing the print in another solution, termed the fixing bath. The fixing bath used for gaslight papers is different from the ordinary fixing bath. The ordinary plain fixing bath is composed of four parts of pure water and one part of hypo. This plain fixing bath is used for fixing dry plates or films and also in a diluted form for fixing printing-out papers, but as gaslight papers are coated with a gelatin emulsion, and the chemicals used for developing are strongly alkaline, the print, when developed, is very soft. There would be danger of stain and discoloration unless it were treated in a hardening bath; therefore do not use plain fixing bath, but an "acid fixing bath," which will harden the emulsion and clear the print as well. The acid hypo can be obtained from any dealer. It is put up in wooden or pasteboard boxes, and to be ready for use only requires dissolving in water, according to the given directions.

438. **Printing.**—In addition to the trays and solutions for developing, it is necessary to have a printing frame the size of the largest plate or film from which you are to print. By fitting a piece of clean, clear glass in the printing frame any smaller size negative can be printed from equally as well as if the actual size frame were used.

439. To begin with, two dozen sheets of what is known as the *regular grade* of paper should be sufficient. But as

gaslight paper, if kept in a dry place, will last for months, it would be economy to keep a supply of a few dozen or one-half gross on hand. *For the information of those without experience in the manipulation of developing papers, we would say that the image is not visible on the paper while printing, but appears only when it is placed in the developing solution.*

440. As stated in a former paragraph, the different manufacturers make many grades of papers, yet for the beginner we would advise the use of the "regular" grades only. In subsequent instructions you will be taught how and when to use the different "special" grades. The regular carbon grade papers are intended for thin negatives, and as most beginners' negatives are thin, better general results will be obtained with this paper.

441. **Printing and Developing Outfit.**

While it is possible to get along very nicely with but two trays, one for developing and the other for fixing, provided an ordinary clean wash bowl can be used for final washing, yet, as the majority of failures are due to the careless handling of the prints, we recommend the following:

1 5x8 tray, to be used for developing *only.*
1 5x8 tray, to be used for fixing bath *only.*
1 5x8 tray, to be used for intermediate washing.
1 5x8 tray, to be used for final washing.
1 printing frame, size of largest plate used.
1 package of printing paper.
1 8-ounce glass graduate.
1 glass stirring rod.
1 package or tube of developing powder.

1 package of "acid hypo."

1 ounce of bromide of potassium.

1 dozen sheets non-linting blotting paper.

442. The above outfit is for printing and finishing 4x5 or 5x7 prints. If larger prints are to be made, the trays should be in proportion. Again, we would caution you to use the respective trays only for the purpose intended, viz., developer tray for developing, hypo tray for fixing, and water tray for washing. Label each tray so that there will be no danger of mistake, for should the hypo tray be used for developing, even after very careful washing, a slight trace of the fixing salt may ruin the developer and cause the prints to be spotted. It is, therefore, very important that each tray be used for one purpose only.

443. **Artificial Light.**—While it is perfectly practical to make prints by daylight, yet, for the first experiments, we advise the use of artificial light (kerosene lamp, gas or electric light). Daylight being so much stronger, the beginner is apt to meet with many failures, while artificial light allows of more latitude and less danger of over-printing.

444. **Loading the Printing Frame.**—First, with a soft cloth remove all dust from the printing frame and cover; then with the same cloth clean the glass side of the negative. If a film negative is used, the back of the film must be carefully cleaned and the plain glass that is used in the printing frame, to support the film must be thoroughly cleaned on both sides. Next, lay the frame on the table, remove the back, and place the negative—gelatin side up—in the frame. Lift one end of the negative up above the printing frame; then, with a camel's hair brush (or a piece of soft cloth), carefully dust the plate by drawing the brush over the neg-

ative. If brushed without raising the negative out of the frame, the dust would only be carried from the plate into the edges of the frame, where it will cause white specks on the print. (See Illustration No. 49.) Next, on the shaded side of the table (See Paragraph 449), away from the direct light, place the printing paper on the negative, having the sensitive side of the paper come in contact with the film side of the negative.

445. The sensitive surface side of the paper must come in contact with the face of the negative. To detect the sensitive side, you will note that these papers are packed in small packages, face to face, while in gross boxes the paper is packed all facing one way. The paper, almost always, curls a little, the sensitive side curling in.

446. In the regular medium weight papers, one can judge the sensitive side by the sense of touch. Catching one corner of the paper between the thumb and the first finger, the side that feels smooth is the sensitive side. Of course the fingers must be perfectly dry or they will stain the print. Another test is to bite a corner of the sheet and the side adhering to the teeth is the emulsion side. A further test is to moisten the thumb and forefinger just a little, squeeze the corner of the paper, and the sticky side is sensitive. Testing the first sheet of the package will supply you with the key to the remaining sheets without previous testing. Remember that the paper is packed face to face, in small packages, and all one way in gross packages, and also that it curls slightly toward the sensitive side. The paper must be kept dry and away from any water or trays containing water.

447. Having placed the sensitive paper on the negative,

next place the back of the printing frame in position, press it down and fasten both springs. The negative is now ready for printing.

448. The accompanying half-tone will illustrate the printing by a kerosene lamp; however, the same procedure can be applied to any light.

449. In Illustration No. 55, a lady, in the act of printing, is seated at the end of a table, on which is placed the lamp. One-half of the table is shaded by a large piece of cardboard, which is placed in the center. The distance the printing frame is held from the light is equal to the diagonal measurement of the negative, which distance is necessary to secure an even illumination of the negative. After sufficient exposure has been given, she returns to the other end of the table (shaded end, see Illustration No. 56). Here, besides the box or package of paper, are the different trays, as labeled—developing, washing and hypo—all ready for use. The sheet of cardboard between the lamp and the trays excludes all direct light, but allows sufficient diffused light for the student to watch the development of the print. As this cardboard is to prevent the direct rays of light from striking the trays or paper, it should be fully 16x20 inches in size.

450. To hold the cardboard in position a number of books can be placed on the table, but it would be much better to have a wooden base to prevent tipping; or, in place of this cardboard make a light wooden frame, 16x20, and cover it with yellow postoffice paper. This will give more light, and the light coming through the yellow postoffice paper will do no harm to the sensitized paper or the prints while developing.

451. **Exposure.**—In making the first exposure, cut a sheet of the sensitized paper into narrow strips (about an inch wide). One of these should be placed on that part of the negative showing the highest point of light as well as the deepest shadow. (This is done, of course, when loading the printing frame.) As stated in a former paragraph, the distance to hold the printing frame from the light is the diagonal measurement of the negative, or, for a 4x5 plate from 6 to 7 inches. Weak or thin negatives require less time than dense or strong negatives.

452. Thin negatives, or negatives of average density (size 4x5 or smaller), printed on the regular or carbon grades, will require about 50 seconds' exposure to an oil lamp, about 30 seconds to a 16 C. P. electric or 4-foot gas burner, and about 10 seconds to a Welsbach burner. If, after developing, you find the print too light or too dark, try another strip of the sensitive paper, being governed in the second exposure by the result secured on the first strip. If the print flashes up instantly in the developer and turns dark in a second or two, you will understand that it is overexposed and half the exposure will be sufficient. If, on the other hand, the print develops slowly and gradually turns gray and foggy, more exposure must be given. If the print develops flat with proper exposure, dilute the developer with water—about one-fourth—and you will gain more contrast. If the print develops contrasty use full strength developer, as the weak developer gives contrast and the strong developer gives softness even to flatness.

453. Negatives vary greatly in density and lamps supply different strengths of light, so it is impossible to give definite directions for making the exposure. Until you

Illustration No 55
Printing at End of Table
See Paragraph No. 449

Illustration No. 56
Developing at Table
See Paragraph No. 449

Illustration No. 57
Applying Paste
to Back of Print
See Paragraph
No. 468

Illustration No. 58
Method of Picking Up Prints after Applying Paste
See Paragraph No. 468

Illustration No. 59
Bringing Paste Side of
Print into Contact
with Mount
See Paragraph No. 468

learn to judge the density of the negative you should always use the test strip. When the correct exposure is obtained in this way, a full size sheet of paper can then be printed and all subsequent prints should be equally good.

454. Compare the next negative you wish to print from with the first one, being guided by the exposure given that one. In a short time you will be able to estimate the exposure required for any negative.

455. **Recording Exposures.**—A good plan, after having ascertained the correct exposure for a negative, is to write on one corner of the film, with ink, the number of seconds required to print and the kind of light used. The initial letter is sufficient. In this way, when printing from this negative again you will not have to experiment to get the exact exposure.

456. NOTE: Always load the printing frame in diffused light, behind the cardboard or yellow postoffice paper screen; also develop by the same kind of light. Cover the box containing the paper immediately after loading the frame, as exposure to white light or even constant exposure to subdued light would ruin it. By following the above rule you will avoid fog and waste of paper.

457. **Developing.**—Suppose that the exposure has been made and that everything is in readiness to develop the print. All trays having been thoroughly cleansed, place the tray labeled "developer" to the left, near the cardboard partition, a tray of clear water next, and the fixing tray behind the water. Fill the water tray a little over half with clear water; prepare the acid hypo bath in the fixing tray, then wash your hands thoroughly so as not to carry any trace of the hypo into the developer, and next pour enough

developer into the developing tray to fully cover the print.

458. Use plenty of developer and keep it cool. Immerse the print—face up—sliding it underneath the solution quickly, and covering the whole surface of the print evenly with one sweep of the developer. Regular or carbon papers should be developed in about fifteen seconds. Should air-bells form on the surface of the print, when first placed in the developer, break them at once with a tuft of cotton, (kept on hand for the purpose), dipped in the solution, or with the tip of the finger. If not broken, white spots—undeveloped spots—will be left on the print. Never dip the fingers into the developer, after having them in the hypo, without first thoroughly washing the hands. To do so would ruin the developing bath. Always remember that hypo is a bitter enemy to all other chemicals, and a single drop of hypo in any other bath would be likely to ruin it.

459. **Restrainer.**—If the high-lights (whitest parts of picture) are gray and the print has developed clear detail, it is apparent that sufficient exposure has been given, and the gray tone comes from too rapid development. The bath must, therefore, be restrained by adding a few drops of a 10 per cent. solution of potassium bromide to the developer. The 10 per cent. solution is made by dissolving one ounce of potassium bromide crystals in 9 ounces of pure water. Be very careful not to use more of the potassium bromide solution than is absolutely necessary to keep the whites clear, as an excess of the restraining agent will not only retard development and produce contrasty prints, but will produce greenish prints as well.

460. **Fixing.**—Watch the print carefully during development, and agitate the developer by moving the print

around. When it is dark enough remove it from the bath. Act quickly, as the print grows darker each second, and the development will continue until the print is immersed in the hypo bath. Upon removing the print from the developer, dip it in fresh water (which should be in the second tray) for a second, and then place immediately in the third tray containing the acid fixing bath.

461. **Handling Prints in the Fixing Bath.**—Each print, as it enters the fixing bath, should be turned over several times, that the hypo may act evenly on the entire print. After the print is thoroughly immersed, there is no danger of staining from laying in the bath until all the prints are developed. They should be handled in the fixing bath, one at a time, care being taken that air-bells do not form, as they will cause yellow stains on the prints. This stain is due to the continued action of the developer still in the emulsion, which has not been stopped by the hypo. Do not leave the prints packed together. Keep them separated, and leave them in the fixing bath for fully fifteen minutes, meanwhile moving them continually.

462. Use the *left hand* for handling the prints in the developer and rinse water. Use the *right hand* for the prints in the fixing bath and final wash water. Make this a rule, stick to it, and you will avoid much trouble.

463. Where small batches of prints are made, the hypo bath may be used continually, but do not fix more than thirty 4x5 prints in 16 ounces of hypo solution. If you attempt more than this number some of the prints are apt to be unfixed, even if allowed to remain in the bath a longer time, and they will not be permanent. This is due to the fact

that sensitive salts still remain in the print, and when these are continually exposed to the light they turn brown.

464. The temperature of the fixing bath should not be above 65°, but it may be cooler. The prints can remain in the bath fifteen minutes, providing it is cool. If the bath becomes warm the acetic acid becomes more active, giving the solution a milky appearance and deteriorating it very rapidly—often producing yellow and muddy prints.

465. **Washing the Prints.**—The prints should be washed, after fixing, at least one-half hour in running water, during which time they should be handled over and over. As the surface of these prints is a gelatin emulsion, they stick together as soon as they fall to the bottom of the tray and will not wash. If you are not supplied with running water the prints may be washed by hand. For this purpose two trays should be used, filling them with water, then passing the prints—one at a time—first from one tray to the other, and then refilling each tray with fresh water after all the prints have been removed. Ten changes by hand should be sufficient to remove all traces of chemicals. Prints will change color, in a very short time, when these chemicals are not removed.

466. After thorough washing the prints should be mopped off with dry blotters, and placed face down on cheese-cloth. This will prevent curling to a certain extent. If overlapped or piled upon each other they will stick together. When blotted off with non-linting blotters before laying on the cloth, they will dry much faster. To have the prints lie perfectly flat after they become surface dry, lay them between sheets of plain cardboard on a table,

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under a light weight, for about ten hours or more, when they will remain perfectly flat.

467. **Trimming Prints.**—If prints are to be mounted, trim while wet, in the following manner: Take a square sheet of glass, wet it and place the print—face down—on the same. Turn the glass over and the prints will then be on the under side—face up. Move the print to the edge of the glass, and with a pair of sharp shears trim one end of the print; then slide the print to the other edge of the glass, and square it to the trimmed edge of the print, and trim in a like manner. After the print is trimmed, place it back in the tray of water and proceed in like manner with the rest of the prints until all are trimmed; then lay them out on a glass plate or other smooth surface, face side down, one print overlapping the other until all are on the plate. If you desire to trim prints when they are dry, a trimming board may be used.

468. **Mounting Prints.**—Remove the excess water, by pressing the prints with the palm of the hand, and then with a dry blotter. With a paste brush apply ordinary starch or prepared paste to the back of the top print. (See Illustration No. 57, applying paste.) Pick the print up at one corner (See Illustration No. 58), bringing the paste side in contact with the mount (See Illustration No. 59). After carefully squaring the print on the mount, place a clean, dry blotter over it and rub down with the ball of the hand, or with a squeegee roller, removing all air bubbles and securing perfect contact with the mount. Allow it then to dry. Any superfluous paste on the print or mount should be removed with a soft wet sponge. For further instruction on Trimming and Mounting, see Chapter XXV.

CHAPTER XVIII.

Developing Papers—Difficulties.

469. **Print Refuses to Develop.**—If the print was properly exposed and the sensitive side of the paper was next to the plate, and the print still refuses to develop, you may have made a mistake in preparing your chemicals, or you may have become confused regarding the trays and are trying to develop with the hypo bath. Be very careful to label each bath and tray.

470. **Green Tones.**—These are generally caused either by using too much bromide, by over-exposing, or by using too weak or too old a developer.

471. **Gray Whites.**—If there is not enough bromide in the developer, the whites will turn gray. Add a few more drops of your 10 per cent. solution of bromide. If the print is under-printed and forced in development, it will cause a graying of the whites. It is also possible that the paper has been fogged by white or actinic light before printing or during development.

472. **Irregular Stains or Blotches** are usually caused by not flowing the entire print with one sweep of the developer; too long development before fixing; not keeping prints moving in the hypo bath.

473. **Stains All Over the Print** may come from any of the following causes: By forcing development of an under-exposed print; by using too weak a developer; by not fixing sufficiently; or by not washing carefully after fixing.

474. **Yellow Whites** are caused by under-printing and then trying to force the print by prolonged development.

475. **Prints Too Light.**—If your prints are too light it is probably because you have under-printed. Give a little longer exposure.

476. **Prints Too Black.**—Possibly over printed. Expose less.

477. **Weak Prints.**—Possibly the negative was too contrasty. Use full strength developer and be careful not to under-print.

478. **Flat Prints.**—Negative is probably very thin, weak in the high-lights and weak in the shadows. Dilute your developer about one-half, and be careful not to over-print. Remember, that diluting developer on gaslight papers gives contrast; strong developer gives softness.

479. **Print Too Dark After Fixing.**—This would indicate that the print was fully exposed, and should not be carried quite so far in the developer. Full timed exposures can be improved by removing the print from the developer just before it is dark enough. It will develop a trifle in the water, and unless thoroughly rinsed will continue to darken until it reaches the hypo bath.

CHAPTER XIX.

Water Tone Platinum Paper.

480. **Eastman W. D. Paper.**—The W. D. Platinum Paper, manufactured by the Eastman Kodak Company, is a paper not unlike the regular platinum paper, and on which pure platinum and absolutely permanent tones can be obtained. It is especially adapted for the amateur, on account of its extreme simplicity of manipulation, as it requires nothing but water and acid for the entire process of development and clearing. When using this paper follow the instructions which are furnished by the manufacturer and accompany each package. We would call your attention to the following points, which must be remembered:

481. **Effect of Moisture.**—"Water-Tone" Platinum Paper is very easily affected by moisture; it will, therefore, be necessary to exercise care when printing in damp weather.

482. Print by direct light (sunlight preferred) until the shadows are clearly outlined *in a deep canary color.* At this stage the same detail will be observed in the half tones that the finished print will show. For developing, use plain water, heated to 120° (which will be as hot as the hands can bear).

483. The development will be practically instantaneous, and care must be taken to avoid air bubbles forming upon the surface of the prints. Place the prints, after de-

veloping, directly into a clearing bath of muriatic acid, one dram to twelve ounces of water, and let them remain in this bath about ten minutes, when they are ready for the final washing of fifteen minutes in running water, or five changes of about three minutes each. Lay out between blotters to dry and mount by applying paste to the corners.

484. **Keeping the Paper in Good Condition.**—This paper is put up in tin tubes and sealed with rubber tape. This is to prevent the air from coming in contact with the paper and to keep it free from all moisture. If the can is left open for any length of time the air will affect the paper to such an extent that it will be almost impossible to produce good prints.

485. The effect of dampness is a lack of vigor, a general muddiness of the tones, and where the paper has been exposed to its influence for some time it injures the purity of the whites. The paper will keep for months, but must be stored in a cool, dry place, in the cans in which the paper is supplied. When paper is removed from the tube, see that the sheets not intended for immediate use are returned to the tube and the tube again carefully sealed with the tape.

486. **Depth of Printing.**—It will require a little practice to be able to print to the proper depth. The paper should be printed only until the image is fairly visible, and then developed with hot water, no chemicals being needed. As this paper is easily affected by moisture, it will be noticed that in warm, damp weather the print will show quite a tendency to print out black in the deep shadows. Pay attention only to the high-lights, as the same amount of printing is necessary as on dry days. In fact,

in damp weather you must print a trifle stronger than in dry weather.

487. **Clearing Bath.**—The muriatic acid used in the clearing bath must be chemically pure or yellow whites will result. The necessary developing cheimcals are already in the paper. Never use any hot water which contains iron rust, as this iron rust will cause black specks on the paper. Care must be taken to avoid air-bells forming on the surface of the print. If they occur and they are not broken at once white spots will be produced. Remember:

1. That the paper must be kept dry at all times.
2. Placing the paper on the negative, or examining prints, must be done in weak, subdued day or gaslight, or the high-lights will become fogged.
3. When developing slide the print face side up into the hot water, so as to prevent the formation of air-bells. If any air-bells should form, break them at once by touching with the tips of the fingers.
4. Prints must be placed directly from the hot water into the acid clearing bath without previous washing.
5. The last clearing bath must be free from all yellowness; then you can feel sure that your prints are cleared thoroughly.
6. Chemically pure hydrochloric acid (muriatic acid) must be used in the clearing bath, and a fresh bath must be used for each batch of prints.

488. **Mounting.**—Prints may be mounted solid in the usual way, by using any good starch paste, and bringing the print into contact with a print roller. Usually these prints look better when only pasted at the edge. In order to do this they must be first dried by mopping off the surplus water and then placing between blotters for several hours. Usually it is best to place them in the blotters, and

after changing to dry blotters once, allow them to remain over night. The following morning they will be dry and flat ready for pasting to the card or mount.

SUGGESTIONS.

489. A good method of development is to hold the print over steaming water until development is nearly completed and then immerse for a few seconds in hot water. This method gives particularly rich, brilliant prints.

490. When negatives are under-timed or weak thin negatives are to be printed from, strength can be gained by printing under blue glass; printing in the shade will also add to the brilliancy of prints from such negatives.

CHAPTER XX.

Aristo Gold Paper.

Aristo Gold Paper is a collodion matt surface paper, requiring no toning bath, the emulsion containing the necessary toning chemicals.

Directions.

491. **Printing.**—Print Aristo Gold Paper like you would regular gelatin printing-out paper, according to the depth of tone desired in the finished print; but if a good, strong print is desired, you should print until the highlights (the whitest parts) are slightly bronzed. The character of tone depends on the depth of printing. Make a trial of two or three prints, printed to various degrees, as a guide for the tone you most desire.

492. **Sepia Tones.**—Wash the prints thoroughly in six changes of water, separating the prints in each wash by hand. Fix for 20 minutes in a hypo bath 30 grains strong, hydrometer test, which is equivalent to three ounces of hypo crystals to 32 ounces of water. After prints are fixed wash in 10 changes of water, separating them constantly for five minutes in each water. After washing they are ready for mounting.

493. **Purple Tones.**—After printing place prints, one at a time, face down, in a tray containing 16 ounces of water, to which has been added ¼ ounce of common salt. When the prints are all in, turn over the entire batch, bringing

prints facing bottom to the top. In this solution the prints should be kept constantly in motion and thoroughly separated. Allow them to remain until a purple tint appears. When the desired tone is reached, transfer to a tray of clear water, where they should be left until the entire batch is fully toned; then transfer to another tray of clear water containing just enough carbonate of soda to make it soft. Handle the prints over in this water for five minutes; then remove to hypo bath and fix. Finally wash according to the directions given above.

494. **Caution.**—A strong, harsh, or contrasty negative will not produce the best results on Gold Paper. Negatives should be fully timed, but retain snap and brilliancy.

495. Tones on Gold Paper are governed to a great extent by depth of printing.

496. Cleanliness is vitally important in the manipulation of prints. See that trays are kept perfectly clean.

497. To clean a tray, throw in a handful of salt, adding just enough water to moisten it; then scour very carefully and rinse thoroughly.

498. **Aristo Gold Post Cards.**—This product is the same as used for the Aristo Gold Paper, except that the stock is of *heavy grade, coated with Aristo Gold emulsion. Beautiful Carbon Sepia, or rich purple tones can be obtained without a toning bath.*

Directions.

499. **Printing.**—Print until all detail is out, or about two shades deeper than the finished print.

500. **Washing.**—Wash in six changes of water, separating the cards thoroughly in each immersion.

501. **Hypo Bath.**—Fix for 20 minutes in hypo bath, 30 hydrometer test (or three ounces of hypo crystals to 32 ounces water).

502. Wash one hour in running water, or 16 changes by hand, separating the cards thoroughly in each water. Dry between photographic blotters.

503. **Purple Tones.**—For purple tones treat in the same manner as for the Aristo Gold Paper.

CHAPTER XXI.

Aristo Carbon Sepia.

A self-toning collodion emulsion, coated on Post Card stock. Requires no toning bath. Produces rich carbon sepia tones.

Directions.

504. **Printing.**—Print until the high-lights are well tinted.

505. **Washing.**—Wash in six changes of water, of about 70° temperature, separating the prints thoroughly in each water.

506. **Hypo Bath.**—Fix twenty minutes, or until the shadows are well cleared up, in hypo bath, 30 degrees hydrometer test, or in three ounces of hypo crystals to 32 ounces of water. Handle the prints constantly in this bath and keep them well separated.

507. Place the prints from the hypo bath into a salt bath of four ounces of common salt to a gallon of water. Keep them well separated in this bath for 10 minutes. Then wash one hour in running water, or in 16 changes by hand, separating the prints thoroughly in each water. Dry between clean photographic blotters.

508. For PURPLE TONES treat the same as in directions for Gold Paper.

509. **To Flatten Prints.**—Take a piece of two or three inch gas pipe, or a paste board mailing tube, two feet long,

and cover with clean paper, pasted to the tube. Cut a strip of heavy, strong paper several yards long and two feet wide. Attach one end of the paper to the tube with paste; then place the prints face down on the paper and proceed to roll up the paper until all the prints are enclosed in the roll. Let them remain in the roll for an hour. Should the prints curl too much reverse them in the roll for five to ten minutes.

CHAPTER XXII.

Aristo Self-Toning Paper.

510. As its name implies, this paper requires no toning or developing solutions, and can be worked with an ease and certainty which cannot fail to delight users of gloss paper.

511. **Aristo Self-Toning Paper** must be printed in daylight. The printing should only proceed to a point slightly in excess of the depth required in a finished print, thus rendering it a quick printer in addition to its self-toning advantages.

512. It has great latitude in printing and secures full values from negatives ranging from soft to medium intensity. It will be observed that the amount of salt in the water will govern to an extent the depth of tone.

513. **Printing.**—Print a very little darker than the results desired in the finished print.

514. **Salt Bath.**—After printing place the prints, one at a time, face down, in a bath composed of:

Water	64 ounces
Table Salt	1 ounce

515. Employ at least one quart of this bath for two dozen cabinet prints. Allow the prints to remain in the salt bath about five minutes, keeping them face down. See that they are well separated by handling them over four or five times, flattening them a little each time by pressing

to the bottom of the tray. This will, to a certain extent, prevent curling.

516. Use trays large enough to maintain the bath at a depth of never more than one-half inch. Keep the prints as flat as possible, care being taken that they are frequently separated to give the salt free action over their entire surface. The temperature of the bath should be about 75°. Never should it be used cold.

517. As prints are toned, transfer them to a tray of clear water. When toning has been completed, put them through a solution of carbonate of soda, to prevent bleaching, and also to neutralize the prints. For this solution use one-half dram carbonate of soda to 64 ounces of water, handling the prints over five minutes in the carbonate of soda, after which transfer them directly to the fixing bath.

518. **Hypo Bath.**—Place the prints directly from previous bath into the following fixing bath: Hyposulphite of soda, 30 hydrometer test, or one ounce of hyposulphite of soda crystals to each ten ounces of water. Do not use less than one quart of this bath for a small number of prints. Allow the prints to remain in the hypo bath fifteen minutes, keeping them face down and well separated by handling.

519. From the hypo bath throw the prints into the salt wash (four ounces of salt to the gallon of water), handle them over in this bath for five minutes; then wash in twelve changes of water, allowing five minutes in each.

520. **Note** (*a*).—Trays for Aristo Self-Toning Paper should be thoroughly scoured with salt and rinsed well before using. Washing trays with alkali retards the toning.

521. **Note** (*b*).—Only pure water, testing neutral with litmus paper, should be used for making a salt bath for self-toning paper. Water containing alkali will not give the best results. Distilled or ice water may be used with excellent results.

522. **Note** (*c*).—Be careful to use a sufficient quantity of salt bath for the number of prints. Prints should be kept in the salt bath only until the desired tone is reached, whether it be two or ten minutes. Remember, the salt solution is nominally the toning bath, and prints should be handled in this the same as in the other toning baths. One quart of salt water is sufficient for two dozen 4x5 prints or their equivalent.

523. **Note** (*d*).—Different amounts of salt give various tones on this paper. For older paper use more salt; one and one-half to two ounces of salt to 64 ounces of water.

524. **Note** (*e*).—After prints come from carbonate of soda bath they can be washed in one clear water and then flattened for five minutes, when they will lie flat in the hypo bath and not curl. Care must be taken to keep the prints flat during toning and fixing.

525. **Note** (*f*).—Should prints show sulphurization in the hypo bath, a few drops of stronger water of ammonia added to the bath will stop this trouble. Too much will give muddy prints.

526. **Note** (*g*).—If prints show blisters after hypo bath, they should be put in a salt water bath for from five to ten minutes; salt, four ounces; water, one gallon.

527. **Note** (*h*).—Washing by hand after hypo bath in eight to ten changes of water will prevent streaks, or lines.

528. **Note** (*i*).—Yellow stains are caused by too weak a salt bath, an acid fixing bath, or allowing prints to adhere to one another when first placed in the hypo bath. Great care must be taken to separate prints when they first go into the hypo bath, or yellow stains may appear, which no after fixing will remove.

529. **Note** (*j*).—In handling Self-Toning paper, should trouble come from chipping or cracking of the collodion film, it is caused by prints being allowed to curl during the manipulation. To overcome this trouble keep prints flat in the salt bath, care being taken that they are frequently separated so that the salt will have free action on their surface. After salt bath, drain them face down on the bottom of the tray for ten or fifteen minutes before putting into the hypo bath. This sets the prints in a flattened position. By handling them face up through fixing bath and final wash water, little trouble is experienced on account of tendency to curl.

530. All self-toning papers have the necessary toning ingredients in the emulsion. When the prints are placed in the water the emulsion becoming wet, the ingredients grow solvent, liberating from the paper, and when coming in contact with water form a toning bath. The action of the toning bath is similar to any other toning bath. The warmth of tone is regulated by the depth of printing, and the amount of washing previous to fixing. The purple tones are controlled by the strength of the salt bath.

531. **Practice Work.**—While this process is extremely simple, yet the very best results are only obtained by practice and experimenting. The richest tones and the brightest prints are obtained by accurate printing. The tone and

color of the print are governed by the strength of the salt bath. You should print a number of sheets of paper, carrying them to different depths, and observe the appearance of each print during the various manipulations. All necessary data should be noted on a few of the prints of different qualities, and these sheets should be filed in your proof file for future reference.

CHAPTER XXIII.

The Kallitype Process.

532. **Introduction.**—Of the various simpler processes which admit of practically any kind of paper being prepared and sensitized by the individual worker, the process known as kallitype embodies a method of printing which, although known and used for many years, deserves a much greater list of users. The three strongest points in its favor are: First, the extremely small expense connected with the process; second, the close imitation which the final print bears to the more expensive platinum process; and third, the simplicity of sensitizing, printing, developing and fixing.

533. The rapidly increasing scarcity of metallic platinum makes it necessary for the amateur worker to obtain something to take the place of platinum paper. It is not necessary to look further than the kallitype for results quite as good as will be found in platinum. The permanency of the kallitype is just as good as any other silver process. The richness of deposit in the metallic particles usually associated with the platinum image can equally be claimed for the silver image of the kallitype, the basis of both being ferro-oxalate. In fact, kallitype at its best cannot be distinguished from platinum.

534. In the first experimental stages of this process it was customary to coat the paper with a solution of ferric-oxalate (an iron salt) and develop the image which was

secured by printing through a negative in strong daylight, in a bath of silver nitrate. This method was soon discarded for another, in which the iron and silver were combined in the sensitizer and the faint image which was secured in printing brought to full strength in a solution of rochelle salts, borax, or a combination of the two. In fact, this is one of the simplest methods of procedure, and we give here the process in its simplest form.

535. **Theory of Process.**—Upon exposure to light the ferric-oxalate is reduced to a ferrous salt, which when dissolved by a suitable solution has the power of reducing silver nitrate to a metallic silver, and this reduction takes place in that degree in which the light has altered the ferric salt.

536. **A Satisfactory Formula.**

Ferric-oxalate	75 grains
Silver Nitrate	30 grains
Distilled Water	1 ounce

This bath may be prepared in any quantity, but in the same proportions.

537. The ferric-oxalate should be dissolved in the water first and care must be exercised at this stage. It requires warm water to dissolve it, but this must not be too hot, or it may spoil the oxalate. After it is dissolved, the liquid should be cooled and filtered and the silver nitrate added. The solution should then be quite clear.

538. **The Paper.**—A fairly good quality of paper should be used for the process—good writing or drawing paper will generally be found suitable, although most any paper may be used. Some papers require to be sized first, for which purpose arrowroot should be used. A peculiar feature about the process is that the paper employed has a consid-

erable influence upon the color of the final print, some papers giving a much warmer color than others with the same developer. The nearer chemically pure, however, the paper, the greater will be the success in securing rich black images. Where the cheaper qualities of paper are used it will be difficult to secure excellent blacks; therefore, it is advisable when using cheaper grades of paper to develop for the warmer colors.

539. **Sizing the Paper.**—As previously stated, it is not necessary to size the paper; but if the best of results are to be secured it will be found advisable to coat the paper with a solution prepared by grinding in a mortar 10 grains of arrowroot in about ¼ ounce of cold water, and then adding 5 ounces of hot water and bringing to a boil, when the milkiness will disappear.

540. In sizing the paper you can either float it upon the solution, being sure that all air-bells are expelled, or, the sizing may be brushed into the surface of the paper with a camel's-hair brush.

541. **Sensitizing the Paper.**—Pin the paper to be sensitized on a table or board and apply the solution with a camel's-hair brush or a tuft of cotton (the brush is to be preferred). It is impossible to state the exact quantity of solution to use, as the rough or porous papers require more liquid than those which are well sized or of a smooth surface. The paper may be coated by gaslight, or lamp-light, without fear of fogging it. It is about as sensitive to light as platinum paper and, therefore, should not be unduly exposed to daylight.

542. It should be dried thoroughly in the dark-room, and unless it is to be used at once, stored in a tin tube con-

taining calcium after drying. As the coating is very simple it is not necessary to sensitize large quantities of paper at once; furthermore for black tones the use of freshly-coated paper is essential. Sepia tones are best secured on old paper.

543. **Printing.**—The greatest amount of skill required in this process comes in the printing, much depending upon its being done correctly. The image is only partly printed out, resembling platinum paper in this respect, in that the image is a grayish blue upon a lemon-colored ground. No great difficulty will be experienced, however, if you bear in mind that those portions of the iron salts which are affected by the light are the parts that will come out strong when the developer is applied. Wherever it is desired to have the picture tinted there must, in that same degree, be darkening of the iron salts. Damp paper will not give good black tones and, therefore, one should use the same precautions exercised when using platinum paper. After a few experiments the required depth of printing will be easily ascertained.

544. **Development.**—It is necessary that the print be developed soon after printing, as there seems to be a continuous printing action. If the paper were kept for a number of hours before being developed it would flash up in the developer and show all the appearances of over-printing.

545. **Developing Solutions.**—

I—For Cold Tones.

Hot Water	20 ounces
Borax	7 drams
Rochelle Salts	1 ounce

Hot water must be used to dissolve the borax. After the borax is thoroughly dissolved, the solution should be cooled and the rochelle salts added.

II—For Warm Tones.

Water	20 ounces
Rochelle Salts	1 ounce

III—Restrainer.

Water	5 ounces
Potassium Bichromate	25 grains

546. The restrainer plays an important part in the process—the more used the greater will be the contrast, while the less employed the flatter will be the results. Strong prints may be secured from weak negatives, and vice versa. For an average negative use ½ dram of No. 3 in each 4 ounces of developer.

547. A warm black tone will be obtained on some papers by the use of No. 1, while on others it will give a fine dark sepia.

548. A warm brown tone results from use of No. 2 solution, and intermediate tones are secured by mixing solutions 1 and 2 in the proportion desired.

549. **Developing.**—The prints may be developed by immersing them in the developing solution, but it is preferable to float them on the solution, for when the paper is quite thick and porous air-bells will give considerable trouble when the whole print is immersed. Development takes place rapidly, and when sufficient strength has been obtained the prints should be placed directly, without washing, into the clearing solution.

550. **Clearing Solution.**—No. 2 (developer) 4 ounces; No. 3 (restrainer) 2 to 3 drams. When the print has been placed directly from the developer into the clearing solution, the dish containing the clearing bath must be rocked for a moment or two, when the prints may be left in the bath for not less than 10 minutes. If convenient to do so,

no harm will be done if they remain in this bath for half an hour. After clearing, the prints should be rinsed in two changes of water and then fixed.

551. **Fixing Solution.**

Hyposulphite of Soda	1 ounce
Strong Ammonia	2 drams
Water	20 ounces

The prints should be handled over in this bath for a period of 10 minutes, so as to remove all traces of soluble silver salts which may be left in the paper.

552. **Final Washing.**—A final washing of one-half hour completes the operation. Drying may be hastened by blotting off, or by heat, as there is no gelatin coating to stick or melt.

553. **Important Pointers.**—The sensitizing solution should be kept in the dark.

Never use a brush with a metal binding for sensitizing.

Prints dry a trifle darker than they appear when wet.

Bronzing in the shadows appears if printing is carried out in direct sunlight. Thin negatives should always be printed in the shade.

554. **Manipulating Results by Means of the Restrainer (No. 3).**—It will be found that the more restrainer added to the developer the greater will be the amount of exposure necessary when printing. By applying this to an underdeveloped, over-exposed negative—in other words, a very flat negative—the printing should be carried to a considerable depth, and by using from two to four times the amount of restrainer called for when developing a print from a normal negative, a sufficient amount of contrast will

result. If judgment is exercised it will be found that this restrainer places in your hands a great power with which to manipulate.

555. This process is not generally used in photographic studios, yet is employed by a great many commercial and landscape photographers, as the process is inexpensive. The principal advantage of the process lies in the fact that the printing can be done on almost any kind of material. The sensitizing, printing and developing is all done on short order and some very pretty effects can be produced. You must familiarize yourself with the process to appreciate its good qualities. Select for your initial work some ordinary drawing paper and sensitize it first without sizing, making several experiments in this way. After you have become quite familiar with the process, select coarser paper requiring sizing, and size and sensitize according to instructions, making several prints thereon.

556. A good plan is to size and sensitize a number of different grades and weights of paper. Pulpy paper should not be used for this purpose, as you are apt to be troubled with air bubbles. However, this material may be used if carefully sized before sensitizing, to give the surface a good body. After making prints on all the different surfaces, you will have a pretty fair idea of the process. By noting on the backs of your test prints your observations of the effects of the different manipulations, making particular note of the various qualities of paper which produced the best results, filing all these prints in your proof file, you will establish a record of valuable information for future reference.

CHAPTER XXIV.

Elementary Bromide Enlarging.

557. Note.—*Detailed instruction on Bromide Enlarging is given in Volume II.* This elementary instruction is intended only for those who do not have access to a room that can be arranged specially for enlarging, and for those who desire to make enlargements with little effort, thus familiarizing themselves with the process before taking up the work seriously.

558. Beginners having small cameras, employing small size plates or films, frequently obtain negatives of special artistic merit, the results from which would be very much improved if they were enlarged to about two or three times their size. This can be done very easily, and with very little expense. The enlarging of the negative itself requires some experience, and, perhaps, a larger camera than you possess, but enlarged prints on bromide or gaslight paper may be made from even the smallest Brownie film.

559. Bromide paper is a paper sensitized with an emulsion similar to that on the ordinary dry plate or film, only of much less rapidity, permitting of manipulation by a stronger light than would be safe for plates. A clear understanding of the process will be afforded if the beginner will consider the sheet of bromide paper as being practically a slow dry plate. Also bear in mind that a

positive image is produced by photographing through the negative onto the sheet of bromide paper, with the negative and sheet of paper some distance apart instead of in contact as is necessary when making an ordinary print.

560. This process requires some means of arranging the negative, lens and bromide paper, so that the light will travel through the negative and, by means of the lens, the image on the negative be reflected upon the sensitized paper. The space between the negative and sensitized paper must be enclosed and made absolutely light-tight, so that no light will reach the paper except that which travels through the negative and lens.

561. A simple contrivance suitable for bromide enlarging by daylight is made by the Eastman Kodak Company, and is known as the Brownie Enlarging camera. In it enlargements can be made up to 5x7 inches in size. This camera, as will be seen by Illustration No. 60, is nothing more than a collapsible box, made wedge shape, with an attachment on the small end to receive the film or glass negative, while the wide end is fitted with a paper-holder. About 6 inches from the small end are arranged grooves for the receiving of the lens board and holding the lens in proper position. (See Illustration No. 61.) With the lens in place the cone is closed with small flaps on the outside, as shown in Illustration No. 60.

562. In Illustration No. 62 is presented the Ingento Daylight Enlarger No. 1, which is a solid box made of hard wood. Like the Brownie it requires no adjustment, as it is a fixed focus, requiring only the placing of the negative and paper in the camera and exposing to the light. The Ingento Enlarger is fitted with an achromatic lens and

Ill. No. 60.
Closed.
See Par. 561.

Eastman Brownie
Enlarging Camera.

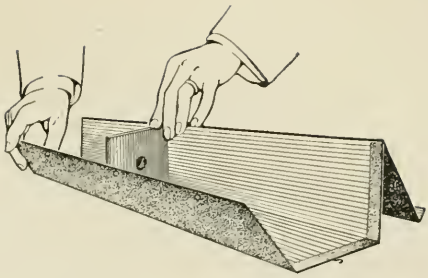


Illustration No. 61.
Sectional View.
See Par. 561.

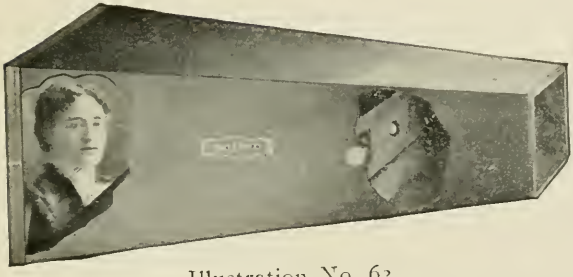


Illustration No. 62.
Ingento Daylight Enlarger No. 1.
See Paragraph 562.

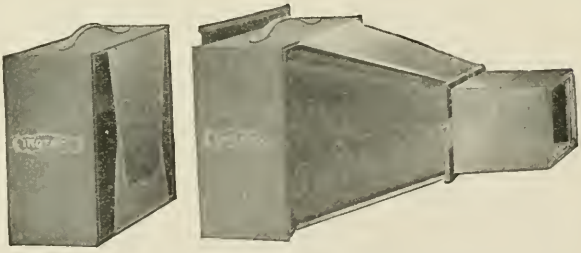


Illustration No. 63.
Ingento Folding Daylight Enlarger No. 2.
See Paragraph 563.

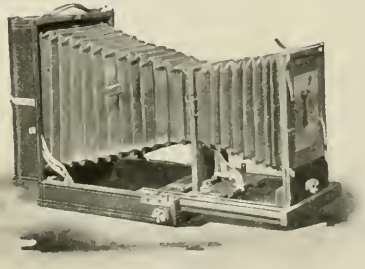
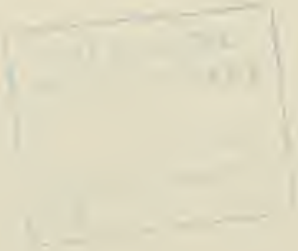


Illustration No. 64.
No. 1 Eastman Kodak
Enlarging Camera.
See Paragraph 564.



sliding shutter, and will make 8x10 prints from 4x5 negatives, and 6½x8½ prints from 3¼x4¼ negatives.

563. A more compact instrument will be found in the Ingento Folding Daylight Enlarger No. 2. The No. 2 enlarger works on precisely the same plan as the No. 1, but is so constructed that it can be folded up into a compact space when not in use. It is also more convenient for loading, being supplied with a plate holder for holding the paper, so that it is unnecessary to take the complete camera into the dark-room (as is required with the enlargers formerly mentioned). The holder can also accommodate glass plates, should it be desired to make large positives or negatives. (See Illustration No. 63.)

564. A more advanced adjustable focus folding enlarging camera will be found in the No. 1 Kodak enlarging camera (See Illustration No. 64). This camera is fitted with a good lens and different size stops and shutter; also has ground-glass for focusing, and is suitable for pictures 6½ x 8½. The front of the camera is fitted with kits, to receive negatives any size up to 4 x 5 inches. Another feature of this camera is that by detaching the front section the camera can be used as a portrait camera—all that you will require is an additional lens for this purpose.

565. **Making the Enlargement.**—First place the film or glass negative in the negative holder, with the face or dull side towards the lens, and attach the holder securely to the narrow end of the box or camera. Next, attach the paper holder containing the sensitive paper to the large end of the camera. With the Brownie and Ingento No. 1 cameras the entire box will have to be taken into the dark-room for loading. With the Ingento No. 2 and the Kodak

No. 1 this is not necessary; all you require is to take the paper holder into the dark-room, and this holder can be attached to the camera in daylight the same as on any camera. When you are ready to make the exposure you draw the slide just the same as you would from a plate holder, and after the exposure is made the slide is again inserted, thus protecting the paper from the light, when the holder may be taken to the dark-room and the exposed paper developed.

566. **Focusing.**—The Brownie and Ingento enlarging boxes require no adjusting whatever, as they are fixed focus cameras, while the Kodak No. 1 is so constructed that by extending both the front and rear bellows to certain points indicated by pointers on the camera bed, you will obtain the largest image possible to make with this camera. When one desires to enlarge only a portion of a negative, which requires more accurate focusing, then focusing must be done on the ground-glass. The lens should be used wide open when focusing. The rear section of the bellows gives you the size of the image. The further the bed is extended the greater will be the size of the enlargement. When you have the bed in position to give the desired size enlargement, clamp it fast, and then focus for sharpness by sliding the support for the lens board back and forth until the image on the ground-glass is as sharp as it is possible to obtain with the large stop; then insert a small stop, which gives you good sharpness throughout, and close the shutter when you are ready for the exposure.

567. **Placing the Camera for the Exposure.**—In making the exposure it is important that the negative be *evenly* illuminated, and that it receive as strong a light as possible,

but not direct sunlight. Placing the camera on an ordinary table, near a window, with the negative end facing the light, will answer, providing the window is not obstructed by buildings or trees. With the fixed focus enlarging camera, such as the Brownie or Ingento No. 1, if desired the enlarging camera may be placed out doors, set on end in a place where it is shielded from direct sunlight, with the end containing the negative directed towards the sky.

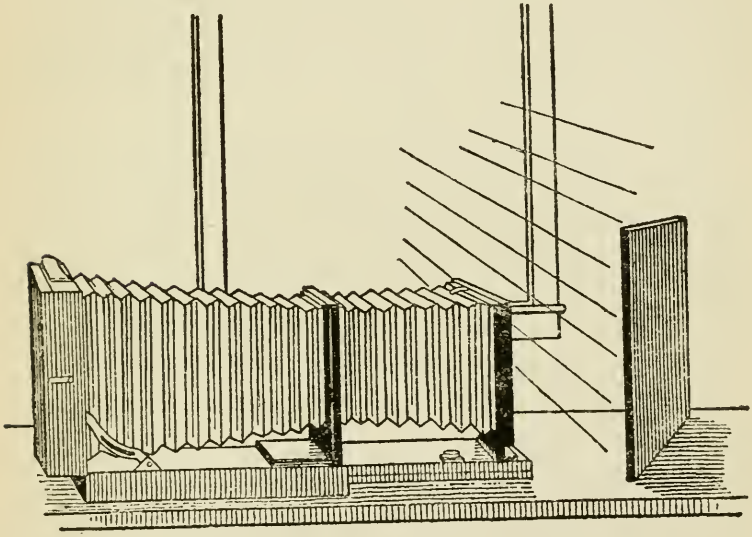


Illustration No. 65
Illuminating the Negative
See Paragraph No. 568

568. Where the window is used, and should there be any obstructions outside, an even illumination may be obtained by placing the camera on a table beside the window, the camera and window being parallel. Provide a piece of white cardboard about 14 x 20 inches, and place it about a foot from the negative, at an angle so as to reflect the light from the window onto the negative (See Illus. No. 65).

569. **Making the Exposure.**—With the Brownie or Ingento enlarging camera, they being always in focus, all that is required, after loading the camera with the bromide paper, is to carry it to the light with the negative covered with some opaque cloth, excluding all light until the camera is placed in a position with the negative end facing the light, when the cover may be removed from the negative and the exposure begun. The length of the exposure with the fixed focus enlarging cameras depends upon the intensity of the light and the density of the negative employed. With a good light and a negative of average density from 40 to 60 seconds may be sufficient.

570. With the Kodak No. 1 Enlarging Camera the exposure depends upon the strength of light, quality of the negative, times of enlargement, and the size diaphragm used with the average strength negative. If the small diaphragm is used from 20 to 30 seconds is usually sufficient; if the large diaphragm is used 10 seconds will suffice.

571. **Testing the Exposure.**—Until one becomes accustomed to judging the exposure required under the different conditions it would be best to use a test strip to obtain the proper exposure. Cut a sheet of paper into three strips. One of these strips arrange diagonally across the paper holder, and expose the strip exactly the same as you would a full sheet, and then develop. The exact time for development of a correctly exposed bromide enlargement cannot be given. The proper exposure, however, may be determined by the appearance of the image in developing. The image of a normal exposure will appear gradually, building up brilliantly and attaining full strength in about one minute.

572. Should the image develop up slow and appear dim and weak in one minute's time, you will know the

paper is under-exposed. Should it flash up quickly, but appear dull and darken all over, in half a minute, you will know it is over-exposed. A correct exposure will develop gradually and grow stronger and more brilliant as it develops, until the shadows are clear and crisp. At this stage the print will be fully developed. After a few trials with the strips you will be able to judge quite accurately the exposure necessary. In some instances where the light is not very strong, or perhaps the negative is thick and hard, it may require two to five minutes for a full exposure. This can very nicely be determined with the trial sheets. After ascertaining the exposure necessary by means of the test strips, then load the holder with a full size sheet and give the same exposure. It would be advisable when you once learn the required exposure for a negative to note the time on the edge of the negative or on the negative envelope. This will save you making a second test when enlarging from the same negative at some future time.

573. **Development.**—After the exposure has been made the next step is the development, which is accomplished in practically the same manner as the development of the plate or film, which, of course, is done in the dark-room. Provide a ruby or orange lamp, and three suitable trays, preferably made of rubber and slightly larger than the bromide paper employed. Bromide paper is not as sensitive to light as the dry plate or film; therefore a stronger light may be employed for developing. A small window opening in the dark-room, covered with two thicknesses of yellow post office paper, will answer; the ruby glass may be dispensed with and an orange colored glass employed; or even a plain piece of glass covered with two thicknesses of yellow post office paper will serve.

574. **Developers.**—For the beginner we would recommend the prepared solution, which is usually put up in concentrated form and requires only diluting with water, when it is ready for use. For those who prefer making up their own developer we recommend the formula accompanying the paper or the following:

575. **Formula.—**

Water	50 ozs.
Metol	¼ oz.
Hydroquinon	1 oz.
Sulphite of Soda (anhydrous)	4 ozs.
Carbonate of Soda	6¼ ozs.

Note—Ortol may be substituted for metol, using the same quantity.

Dissolve the chemicals in hot water and in the order given, and let stand to cool, when it is ready for use.

576. **To Develop,** take 1 oz. of the above solution and add 6 ozs. of water (this is sufficient to fully cover a 5 x 7 print); add to this developer from 6 to 8 drops of a 10% solution of bromide of potassium.

577. **Blue Tones,** or blue black tones, are obtained by using the developer as above.

578. **Olive Green Tones** may be obtained by increasing the amount of bromide of potassium.

579. **Fixing Bath.—**

Hyposulphite of Soda	4 ozs.
Water	24 ozs.

When all crystals are thoroughly dissolved the bath is ready for use. To insure permanent results a fresh bath should be prepared for each day's work.

Blisters will sometimes appear where water of different temperatures is used, but these can usually be avoided by using a little common salt in the first washing water after fixing. A positive pre-

ventative will be found by using the following fixing bath in place of the plain fixing bath:

Hypo	4 ozs.
Water	32 ozs.

When dissolved, add

Metabisulphite of Potash	⅛ oz.
Alum	⅛ oz.

The prints should be thoroughly immersed in this bath, to insure proper hardening of the film.

581. **To Develop.**—Provide three trays: One you use for developing, another for fixing, and the third tray for washing the prints. Where running water from the tap cannot be had the washing tray may be used for rinsing before fixing. After exposure immerse the print in the developer, face side up. The image, if properly exposed, should begin to appear slowly and should develop up strong, clear and brilliant. (See Paragraph No. 458.) Keep the solution moving over the print, by gently rocking the tray. When the shadow portions appear black and solid—not muddy—the print is completely developed; then remove from the developer and rinse under the tap, or place in the tray of fresh water for a few moments, turning the print over several times, after which immerse in the fixing bath. The prints should remain in this bath for fifteen minutes, and handled over occasionally, by hand, to insure even fixing and also to avoid staining. After fixing, the prints should be washed for an hour in running water, or they may be washed in a tray by handling over several times in at least ten changes of fresh water.

582. **Drying.**—After the prints are carefully washed they may be surface dried by placing between clean white blotters, then laid out on dry blotters, face side up, until they become surface dry, when they may be placed between cardboard and put under weight until bone dry.

583. **Trimming and Mounting.**—See following chapter.

584. **Papers to Use.**—For the beginner we would advise the use of the matt surface bromide paper, as this surface of paper is suited to a large variety of negatives. For further information regarding papers and advanced bromide enlarging, sepia tones, etc., see Volume II.

585. **Notes.**—Bromide paper must be placed in the paper holder in the dark-room, by the light of a suitable lamp. Be sure that the paper holder and negative holder are securely attached to the camera. Should any other light than that passing through the negative and lens reach the bromide paper it would cause a fog over the print.

Always exercise care in loading the holder, and before opening the dark-room door, to see that all your unexposed bromide paper is returned to its envelope, where it is fully protected from the light.

Bromide paper should be kept in a *cool, dry* place, away from strong light.

586. **Judging the Face Side of Paper.**—The face of bromide paper can always be distinguished by its curling in; the convex side is always the back.

587. **Fog.**—Fog may be caused by exposing the paper to unsafe light, or by using too little bromide of potassium. The amount given in formula is the minimum that should be used; owing to varied conditions an increased amount may at times be found necessary.

588. **Mealy, flat prints** are caused by over-exposure and short development.

589. **Weak prints** are caused by under-exposure.

590. **Gray prints** are caused by under-exposure and forced development.

591. **Greenish tones** are caused by over-exposure and too much bromide.

592. **Judging When Prints Are Fixed.**—The prints are fixed when looking through them to the light they appear even and transparent. Unfixed portions will be a greenish yellow.

593. **Complete instruction for bromide enlarging and advanced methods will be found in Volume II.**

CHAPTER XXV.

Trimming and Mounting.

594. It is not enough to be able to make good negatives and good prints. The print should have a proper setting, to heighten its effect. The undesirable portions should be trimmed away, and a tasteful mount will greatly improve the finished photograph. Thousands of good photographic prints have been ruined by an unsuitable choice of mount, while indifferent second rate pictures have been greatly improved by discriminate and artistic taste in mounting. Indeed, taken together they have become quite an art in themselves. The best photographers, like the best artists, treat the mount like the frame of a picture, worthy of the most careful thought and study.

595. **Where to Trim.**—As the purpose of all trimming is to improve the print by emphasizing and balancing the principal point of interest, it is evident that trimming is largely a matter of composition. If the picture is properly composed the essential parts of the view will reasonably fill the print. It is only necessary then to have due regard for the decorative effect of the principal lines and masses in the pictures. But sometimes an isolated bit of dark or light comes on the edge. Useless and undesirable details obscure the print and should be trimmed off. It is the concentration of the view that makes the picture. Make it a rule to trim mercilessly—i. e., trim down until the best proportions have been obtained. A square inch of interest is better

than a square yard of monotony. A part is often of more value than the whole. Do not hesitate to sacrifice the half or more of the print, if it benefits or accentuates what remains.

596. In seascapes, take care to have the horizons level. In buildings trim so that the vertical lines are perfectly square. One expects them to be perpendicular, unless the original was out of plumb, as sometimes happens in old buildings or ruins. When the lines are not straight, through neglect to use the rising front in the camera, or the swing-back, tilt the print a little when cutting to compensate for this. Two pieces of cardboard shaped like a carpenter's square, laid on the print and moved about so as to get the most pleasing picture, will be a great help in judging how the print should be trimmed. In all this work be sure that the edges are parallel and the corners are square, regardless of the original size of the plate.

597. **How to Trim.**—It goes without saying that the print should be thoroughly dried before trimming, otherwise there is a certainty either of tearing it or of leaving the edges ragged. The knife may be a common pocket knife, but it should be of good quality steel, with a slightly rounded point; and last, but not least, it must be kept sharp. Some trim with a pair of scissors, but this method does not insure accuracy or straight edges. We therefore recommend the regulation trimming board, with a measuring scale and cutting blade that does this work with neatness and despatch. They can be bought at the price almost of a pair of scissors or of a knife.

598. **Mounting Prints.**—It is only when prints have been properly trimmed, that we are ready to consider mounting them. There are two distinct kinds of mounts,

viz.: commercial mounts that can be obtained ready made from the stock dealers, and artistic mounts, home made combinations of tinted mounting papers or boards. Both kinds are procurable in great variety, to suit all tastes from severe plainness and simplicity to the most artistic creations. However, there are certain general principles that the beginner should always bear in mind to help him in his choice of a mount.

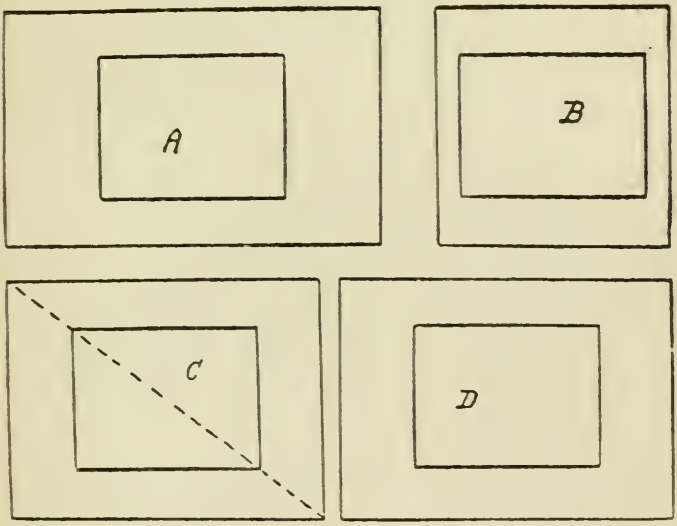


Illustration No. 66
Prints of One Size on Mounts of Varying Sizes
See Paragraph No. 599

599. **Size of Mount.**—First, the size of the mount should bear a certain relative proportion to the size of the print. A small print will carry a larger margin, in proportion, than a large print will. Therefore, a small print should have a relatively larger mount, although it should be remembered that a small picture on a large mount will tend to

dwarf the apparent size of the print. The proportion of the length and breadth of the mount affects the apparent length and breadth of the print. Thus in Illustration 66, A, B, C, D, we have a series of four diagrams where the print remains the same size, but the mounts vary. The best arrangement here is in D. The reader will note that the space above the picture is the same in all four cases. By increasing the end spaces in A the picture looks smaller, but longer than in B, where the mount is very nearly square. In C the mount and picture are in the same proportion, but this is too mathematical to be artistically correct, since it gives us four corner points in a common diagonal. A little variety is better. The print will always look better if mounted somewhat above the middle of the mount.

600. **Texture of Mount.**—A rough print on a smooth mount or a smooth print on a rough mount are both accentuated by contrast with the texture of the surface on the mount. Great differences, then, of surface texture are seldom desirable, as they attract attention and divide the interest with the picture.

601. **Tone and Color.**—Neutral tones are best where the purpose is to emphasize the high-lights and deep shadows of a picture. But the color of the mount should never so closely approximate the print that it blends with it in any way. The color of the mount should harmonize with the predominant tone in the picture, and this it can do in two ways: First, by harmony of analogy (i. e., a tone of the same or similar color); second, by harmony of contrast, where the complimentary color prevails. A suitable mount for any print, then, should either harmonize with its predominant tone or contrast with it along the lines of complement. The first method is the easier for the beginner to

A WINTER STREAM

Study No. 10—See Page 371 By R. E. Weeks

follow, because in selecting the mount he simply continues the predominating tone of the print. In this way one avoids such grave errors as mounting prints with purple tones on gray mounts, or black and white prints on brown and green mounts. There are no color contrasts to black and white; each contrasts with the other, and between these are many grays. The beginner, if he is wise, will mount his browns and sepias on mounts that harmonize with these colors—at least until he acquires a good knowledge of complimentary colors. Hence dark mounts in general should be used for deep toned prints and light mounts for delicate tones—but absolutely white or black mounts should rarely be used. Indeed all bright colored mounts are to be avoided, not only because they tend to attract attention away from the picture, but because of the complimentary color suggested. Extremes of color and even texture are not suitable mounts for photographs, as a rule. Quiet or sombre colors of gray-green or brown, also neutral tints are generally most effective. Grays and browns are always useful, and dull prints may often be brightened up by the addition of a narrow white edge around the print.

602. **Double Mounting.**—In double mounting it is often best to use two or more shades of the same color, showing as rules around the print, rather than to experiment with another color. Double mounting requires a good eye for color effects, and the more line effects used the narrower they should be. It is also important that the different papers of the mount be stuck together and quite dry, before the print is added, otherwise the print will cockle. A dab of paste on the top edge of each sheet will hold them together, and a narrow strip of paste along the top edge of the print will attach it firmly to the mount.

The whole thing, print and double mount, should be left under pressure for some hours.

603. **Pasting.**—To come down to the dry details of pasting the print, use fresh starch paste, or Higgins' Photo Mounter, an excellent and ever ready preparation for ordinary mounting of prints. Good mountant must stick well and promptly; should not affect the print either chemically, mechanically, or by discoloration; must be easy to prepare and easy to use without cockling the mount. The paste should be applied with a flat bristle brush, using as little as necessary but applying it rapidly and evenly. Before the print has a chance to expand lay it on the mount, cover it with blotting paper and pass the squeegee roller over it lightly at first; then gradually with more pressure, make complete and uniform contact. The print will dry nearly flat if kept between blotters and under a heavy weight for a few days.

CHAPTER XXVI.

Supplementary Lenses for Hand Cameras.

604. The lenses which are supplied with most small hand cameras are limited in their scope, and the amateur is often desirous of doing work which his lens will not accomplish. Of course lenses for particular purposes can be purchased, but generally speaking, they are expensive. However, the amateur can readily overcome this difficulty and fulfil his wants by the use of little extra lenses, which are commonly called "supplementary lenses." These are, practically, spectacle glasses ground to give, in conjunction with the lens on the camera, either wide-angle effects, short focus effects, long distance effects, and so on. Such supplementary lenses can be bought ready to slip over the regular lens.

605. **Ideal Outfit.**—The Ideal Photo Optical Outfit consists of a complete set of ideal supplementary lenses, a ray filter and a duplicator. They are made to slip over the lens just like a cap, and are adjustable to any lens generally supplied with a 4 x 5 or 5 x 7 camera. With this outfit there is no limit to the variety of effects obtainable. The lenses are only supplementary, but they give the owner of an ordinary objective lens the advantage of five different focal lengths, which is equivalent to five objective lenses.

606. The outfit consists of one portrait lens, one enlarging and copying lens, one wide-angle lens, one telephoto lens, one ray filter and one duplicator. (See Illustration No.

67.) It is not necessary to purchase this entire outfit, as each lens may be bought singly. When purchasing any of these lenses, the diameter of your lens must be carefully measured and the size given, also the style, make and size of camera.

607. **Portrait Lens.**—This lens is intended for making portraits or large heads, with a short bellows camera. It will increase the speed of your lens and give a softness to the image that is only obtained by the use of a regular portrait lens. Slip the attachment over your lens, and if the frame of the attachment fits too loosely, push the springs in towards the center, so they will hold firmly. The springs must all be pushed in the same distance from all sides, so that the lens in the attachment may be properly centered. Focus the camera with the supplementary portrait lens attached, using the largest stop. The nearer the camera is to the subject the larger will be the portrait. The exposure is made in the usual way. *When ordering supplementary lenses, give make and size of camera, and also measure the diameter of your regular lens.*

608. **Enlarging and Copying Lens.**—This lens, when attached to the lens of any camera, will increase its power so that small objects or pictures may be photographed to their full size, or larger if desired. Draw the bellows of the camera out as far as it will go. Next slip the enlarging and copying lens over the front of your regular lens. Place the camera on a table about 6 inches from the object or picture to be photographed. Carefully examine the image on the ground-glass, and instead of focusing by pulling the bellows back and forth, focus by pushing the entire camera to or from the object or picture, until a sharp image is obtained on the ground-glass.

Illustration No. 67
Ideal Photo Optical Outfit
See Paragraph No. 606

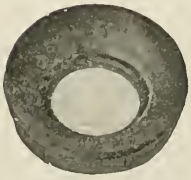


Illustration No. 68
Kodak Portrait Lens
See Paragraph No. 618

609. The above directions explain the method for securing the largest picture possible with this combination. If it is desired to make pictures of actual size or smaller, adjust the bellows until the required size is seen on the ground-glass, and then focus sharply, as described above. In all cases focus with a large diaphragm in the lens, but before exposing change it to a small one. This small stop will increase the depth of focus and cover the plate sharp to the corners. The small stop will, of course, make it necessary to give a longer exposure.

610. **Wide-Angle Lens.**—Attach this lens in the usual way, by slipping over your regular lens, and focus as you ordinarily would, always using the large stop. It is necessary, however, to use a considerably smaller stop when making the exposure. This wide-angle lens attachment will be found most useful for confined situations, more especially interior views where the rooms are small and you desire to show as much as possible of the room.

611. **Telephoto Lens.**—This attachment is to be used for making distant pictures. It will increase the focal length of the regular lens and magnify the picture so that objects at a distance can be photographed larger than with an ordinary lens. Focus in the usual manner, after the lens is attached. Always focus with a large stop, but use a considerably smaller one when making the exposure.

612. **Ray Filter.**—The function of the Ideal Ray Filter is to render the different colors, as seen by the eye, in their correct values on the finished pictures, and to accomplish this a filter is employed which absorbs the violet and blue rays of light, which act most rapidly on the sensitive plate. By this we do not mean that green will appear green or yellow appear yellow, but that the green will appear a

darker shade than the yellow on the picture. A light blue will ordinarily photograph white. With the **Ideal Ray Filter**, however, it will have a grayish tint and the whites will, of course, be white. Thus, fleecy white clouds in a blue sky will be visible in the negative when using a ray filter. Without the use of the filter, however, the sky would be totally white.

613. The advantages of a ray filter are well known, but it must be made optically and spectroscopically perfect to be of any value.

614. The ray filter should be used in photographing landscapes, flowers, colored pictures and views with mountains in the distance. After focusing your view, slip the ray filter over the front of the lens in the regular way, but bear in mind that the exposure must be increased from six to eight times when the ordinary dry plates are being used. With isochromatic plates the exposure should only be increased about three times.

615. **Duplicator.**—By attaching this instrument to the lens of any camera, a person or persons can be photographed in two positions on the plate, without showing any division line where the exposures meet. We will suppose, for example, that it is desired to photograph a person sitting at either side of a table, possibly playing a game of chess or checkers, with himself for an opponent. Place the camera so that the center of the table will be in the center of the picture.

616. After the subject is seated and the camera properly focused, attach the Duplicator by slipping it over the hood of the lens, with the opening on the same side on which the subject is sitting. If the subject is sitting on the right side of the camera, you will notice that the ground-glass on

the opposite side is in darkness. Use a small diaphragm for this work, about f/16. If your diaphragms are not numbered, use the second or third from the largest stop. The right half of the ground-glass, which shows the subject, should project just a little beyond the center of the plate. You are now ready for the exposure. Expose about three times as long as for an ordinary exposure. Next, without moving the camera, turn the duplicator around so that the opening will be on the other half of the lens and have the subject change over to the other side of the table. Make another exposure, giving the same time as in the first exposure.

617. Close the shutter after the first exposure, but it is not necessary to return the slide to the holder. Also see that the side of the opening in the Duplicator is **perfectly vertical.** Exactly the same exposure must be given both sections, and when developing, the plate will develop evenly all over, resulting in a perfect negative showing the subject in two positions, as though it were made with a single exposure. Care must be exercised that neither the camera nor the table is moved when the subject is changing from one side to the other.

618. **Kodak Portrait Lens.**—The Kodak Portrait attachment is simply an extra lens that slips in front of the regular lens. It in no way affects the operation of the fixed focus kodaks, except that it makes a sharper picture at a distance of three and one-half feet, and, of course, throws more distant objects out of focus. (See Illustration No. 68.)

619. These Kodak Portrait attachments may also be used with any of the adjustable focus kodaks. After attaching the portrait lens to any focusing kodak, rack the bellows out until the pointer on the focusing scale points at

fifteen feet. Place your subject at three and one-half feet from the camera and a good bust portrait can be made. Only bust portraits should be attempted with these attachments.

620. By changing the focus it is possible to place the subject at different distances from the camera, thus increasing or diminishing the size of the image. As the Kodak Portrait Lens is intended for use with film cameras which cannot be focused on a ground-glass, accompanying each portrait attachment is a printed table telling, in precise figures, the proper distance on the focusing scale required to correspond with the distance the subject is from the lens.

621. In all cases where portraits or pictures require a time exposure with the hand camera, the instrument must be attached to a tripod or rest on something solid, to prevent jarring of the camera during the exposure. For all portraits in the home at least three seconds' exposure should be given.

CHAPTER XXVII.

Synopsis of Hand Camera Work.

622. The simplest form of photography, when rightly understood, is hand camera work. But it is a mistake to assume that since it is easy to use a hand camera, it is therefore easy to take successful photographs. One must have a certain amount of skill and knowledge to know even how to press the button rightly, for there are certain fixed laws underlying all branches of photography that must be observed and respected. Neglect of these laws results in failures. With no knowledge of them you are like a boat without a rudder—you are kept guessing all the time. Sometimes you guess right, but more often you guess wrong. Occasionally you may get a good picture, but only by accident, as the chances are against you. Therefore, it is a wise plan to study these laws and be governed by them.

623. **Best Hand Cameras.**—First of all, what is the best type of hand cameras to choose? As we have seen, some hand cameras have a fixed focus,—i. e., all images beyond a certain distance are in focus with it. In the focusing camera there is an attachment for indicating distances, a scale or pointer arranged outside the camera. The disadvantage of the fixed focus camera is, that no object nearer than the fixed distance can be photographed, while the disadvantage of the focusing camera lies in the difficulty

in judging distances accurately. Both these difficulties are overcome by the use of the folding hand camera, fitted with a ground-glass as well as a scale for focusing, for, with this camera, if you are in doubt as to the distance, after setting the camera to the scale, prove the distance by observing the image on the ground-glass. The ground-glass focusing camera can also be used for many purposes that the scale focusing camera cannot be used; therefore, many who purchase cameras prefer one that can be used for all around purposes, and the combined ground-glass and scale focusing camera is, therefore, selected.

624. **How to Test the Focus.**—The focusing scale on a hand camera is sometimes faulty. To prove this, mark off, along the ground, the distances from the camera as given on the focusing scale. Insert the ground-glass in the camera and set the scale to the nearest distance. If the objects at a similar distance along the ground are not in focus, the scale is not correct. If the object is in focus the scale is correct.

625. **How to Test Camera.**—Plates are often fogged because the camera is not light-tight. To test this, close the lens, open the back, and throw the focusing cloth over the head and camera. Then hold the camera up to strong light for some seconds and look through it; if any stray light is coming in it will soon be apparent.

626. **The Lens.**—The most important feature of the hand camera is the lens. The lens is to the camera what the human eye is to the individual. If the eye is poor the sight is blurred; so, if the lens is poor, or limited in its capacity, the picture will lack sharpness, detail and parallelism of lines. It is true that an ordinary cheap rectilinear lens oftentimes will make good pictures of landscapes,

marines, interiors, portraits and buildings, under favorable conditions, but when the conditions are not favorable, which is more often the case, the anastigmat lens will be of greater advantage. This lens can be used at a large aperture, which will often save many under-exposures of plates and films, and allow work in a light which with the cheaper lens would be impossible. While a single lens is to be preferred for landscape and marines, it will not take buildings, as it does not render straight lines correctly. Good portrait work requires a special lens. But to take up the question of lenses here is not our purpose, as it can only confuse the beginner. Nevertheless the lens is the vital part of the photographic equipment and should receive careful consideration later. For the moment, remember that the difference between a good and poor hand camera oftentimes lies very largely in the lens. If you take up photography with a view to making good pictures and sticking to it until you succeed, then buy at least a good rectilinear lens at the start. You may be sure that it will only be a short time before you will become disgusted with the cheaper lens, and lay it aside to buy a better one.

627. **To Test the Lens.**—To test the rectilinear lens in any camera, open the shutter, take out the plate holders, and focus on the ground-glass. Cover your head with a focusing cloth. From the picture projected on the ground-glass, the definition and covering power of the lens may be seen at a glance. With a five inch lens at f/8, if we focus on an object 12 ft. away, or set the scale to 12 ft., everything from 8 to 20 feet away will be sharp. This is what is known as depth of focus in the lens. A good anastigmat will cover sharply at open aperture, but distant and near objects will not be defined with equal clearness. The

ordinary rectilinear type of lenses has more depth of focus, but lacks in atmosphere.

628. **Shutters.**—Among the attachments of a hand camera, next in importance to the lens is a good shutter. The best lens in the world will fail when the shutter is unreliable or does not work properly. In purchasing a hand camera then, make sure that your shutter can be regulated from one second to one-hundredth part of a second, and that your lens is fast enough to stand this latter brief exposure. The beginner who has his shutter working at one speed and one opening, and who tries to make pictures at any hour of the day, with any kind of light, cannot reasonably expect to have successful results. There are two types of hand camera shutters, one which has metal discs that pass across the lens, and the other a flexible blind on rollers. The latter is adapted to give the greatest efficiency and the highest speeds. It is best in the focal plane-shutter type, so-called because it lies almost in the focal plane of the lens, i. e., as close as possible to the plate. The former type gives slower speeds and is easier to manage with accuracy, and is, therefore, recommended for the beginner. (See Paragraphs 53-56, Chapter II.)

629. **Rising Fronts.**—The rising front is a very important attachment to the hand camera, as it is available for both upright and horizontal views. It should give a movement of at least a quarter of the length of the plate. With this attachment an excess of foreground can be cut off, and often the tops of buildings or of trees may be included in the view without tilting the camera.

630. **Levels and Finders.**—The level insures correct horizon in the picture, and holds upright the perpendicular lines of buildings, if there are any in the view. It is some-

times very annoying to find that your picture was spoiled because your camera was not held level and upright, which can always be effected with the aid of the level. Large finders are an advantage, as they show a full size image of the view to be taken, and enable one to better see and compose the picture up to the time of taking it.

631. **Films vs. Plates.**—The film and the plate camera both have their advantages even for the beginner. It is a matter of simply learning how to use the instrument at hand and obtain with it the very best results. With the film camera one has the advantage of lightness and portability. With the film pack or the single film one has almost the same advantage of developing each exposure before making others as he would have with the plate, thus enabling him to prove his results as he makes his exposures. Of course with the roll film the manufacturers, in addition to their 6 and 12 spool exposure, also make a double-two exposure film, thus enabling the user to make but two exposures before proving his results, thereby making it unnecessary to expose a complete roll. With the plate camera, while the weight of glass plates is a little more, yet one can by having numerous plate-holders carry as many plates with him as he desires, and when but a single exposure is desired he can make it and prove his result before making more exposures, thus enabling him at all times to profit by his previous experience. Either may be employed successfully by proper care in their manipulation.

632. **Exposure.**—The tendency among all beginners of hand camera work is towards under-exposure. It is a remote contingency that the beginner will over-expose. The older worker, accustomed to time exposures and the

use of restrainers in development, dreads the under-exposure and tries to avoid it. By using rapid plates, a quick shutter and a large aperture in a good light, he over-exposes. While the beginner has not learned how to hold the camera still, or is afraid that if he does not give a very short exposure there will be signs of movement, due to his own unsteadiness with the camera, he will fire off his shutter at the one-fiftieth of a second with his hand camera what he would give a whole second to with his tripod camera. He should not forget, while making his exposure, that there is no possible condition that would emancipate him wholly from the relative values of light, speed of plate or film, speed of lens and shutter, and size of stop. All these are factors that must be contended with. They represent so many natural laws. Though light is most brilliant at midday, the angle at which the lengthening shadows fall between two and four P. M., and the soft clear light of the early morning, between nine and eleven A. M., give the best results in fully exposed negatives.

633. This question of light and color is an interesting one for the beginner, to whom all sunlight is white light. But to the scientist, light is made up of several colors—red, yellow, orange, green, blue, indigo, violet. Now the various colors act differently upon the sensitive silver salts in the emulsion of the plate or film. Blue, indigo and violet rays work the most rapidly; green rays are slower, and the red, yellow and orange rays are the slowest to affect the plate. Therefore, a landscape in which the prevailing color is green, from the grass and trees, with blue from the sky above, will require a shorter exposure than if we were photographing red and yellow flowers together. If we undertake to photograph an oriental rug or an oil

painting we will have, perhaps, all the colors in the spectrum. In that event there are colors to which the bromide of silver is most sensitive, and also those which have the least effect on this salt. If we give the proper exposure to one color we over-expose another, and vice versa. What must be done? There are several remedies, but they are all based on one general principle, viz., that of correcting color value by reducing them all to a common or uniform value. Special plates, orthochromatic plates, for instance, used in conjunction with a ray filter or color screen make it possible to reproduce the various colors in monochrome in their correct values; but the time of exposure is then lengthened very materially. (This is also described at length in Volume III of the library.)

634. In lighting, reflection is another prime factor to be considered. A view, for instance, taken over a body of water, a lake or ocean, will only require one-half the exposure of an ordinary landscape in the open, because of the reflected light from the water. The same is true of snow scenes. Furthermore, the quality of light in a dry climate is much quicker than it is in a moist climate.

635. **Holding the Hand Camera.**—Never point the camera directly at the sun, or the result will be a flare spot on the negative. The direction of the light should be from over the shoulder, as you stand with your back partly to the sun. When photographing a house, for instance, never take a full broadside view, but show a portion of the front and one side. The lighted side is preferable in most cases. Sometimes the position of the camera relative to the objects to be taken may make all the difference between a good and bad picture. A point of view that is low down compresses the ground planes and emphasizes the object in the fore-

ground. This is how reeds, long grass and shrubs are given importance in the foreground of some pictures. On the contrary, a high view-point tends to cut out the foreground which may not always be pictorial. In a general way, the further we are from the subject the higher the camera must be held. Thus for groups 10 or 15 feet distant hold the camera about level with the waist-line; 15 or 30 feet distant, chest high; and for more distant objects, on a level with the chin. The beginner will probably not be able to hold a camera quite still for more than one twenty-fifth of a second. By practicing, it can be held still for a quarter of a second, when conditions are favorable. Never take a snap-shot of a moving object while it is in the shade, as the light is not sufficient to permit of a short exposure. In fact, there is but one good rule with regard to exposure, viz., to expose for the shadows and let the high-lights take care of themselves. To this we add—make no exposure unless you are sure that your subject is worthy of it, and that all the conditions are right for the securing of good results.

636. **Choice of Subjects.**—The novice should never attempt subjects showing strong light and shade contrasts. By strong contrast we mean a snow scene with an inky black river; a narrow street with one side in strong sunlight, the other in sharply defined shadow; a brightly lighted landscape as seen through an open doorway; black and white costumes, etc. Unless the light is good and ample exposure can be given, nine times out of ten such subjects will be failures. Oftentimes unnatural effects are rendered in the picture, due to too rapid exposure. The pictorial effect is gone because the picture was made so rapidly that the motion of the scene which makes the pic-

ture beautiful is lost. All such, if made with a slow exposure—say one-half second—enhance the view.

637. For figure studies in narrow streets where the light is poor, a wide aperture lens is needed. If a lens of this character, working say at f/6, be used, exposures of 1-25 of a second may be given with rapid plates. If the light is very dull a moving object cannot be taken, as sufficient exposure would cause a blurred image.

638. For buildings and architectural work, generally, the lens of a hand camera should be of fairly short focus, and there should be an ample rise to the front of the camera. It is better also to use a tripod when photographing objects of this character. Whenever the exposure is more than 1-25 of a second, set your camera on a tripod, to steady it.

639. **Selection of Accessories.**—Simplicity should be the main object in all pictures. The introduction of figures should be done sparingly. Now and then they add a touch of human interest, but they should not be obtrusive, as they scatter the interest and tend to confuse the picture. Never take a blank sky as a background for a figure study. The face is sure to be black, even though the sun is behind the camera. Place the figure a short distance from some dark object, with an unobtrusive background. If you wish the figure in greater prominence, let the background be slightly out of focus. Then if the figure is posed in a stooping attitude, be sure that there is space in the picture for the figure to stand erect, in one's imagination; otherwise the sense of proportion is destroyed. With rapidly moving objects, when negatives are being made for later enlargement, one must be very careful in adjusting the speed of the shutter so that the blur in the enlargement will not

exceed 1-50 of an inch. The best time for pictures is when the streets are fairly open and when the light is good. When the light is poor, or when the sun is low on the horizon, or when figures are in the shade, the hand camera cannot be used successfully and the tripod must be employed. In making any picture, five things should always be remembered—first, the idea to be conveyed; second, the principal point of interest; third, the accessory points, or figures; fourth, the setting or background, etc.; fifth, the play of light and shade. This is the way to think out any picture.

640. **Exposure Meters.**—The exposure of the plate to the action of light in the camera is of the greatest importance, and most of the failures in negative making are due to incorrect exposure. It depends upon many conditions such as:

The speed of the plate;
The time of the day and the season;
Quality and strength of the light;
Kind of lens and size of diaphragm used, and
Nature of object to be photographed.

641. For instance, clouds, snow scenes, marine or far distant views require the shortest exposures, while groups in the shadow of dense foliage and dark objects must be exposed longer. Interiors of buildings, etc., usually need still more prolonged exposure, so that the same plate may be worked in 1-100 part of a second with large diaphragm and strong light, that requires from ten minutes to perhaps an hour's exposure to photograph a dimly lighted interior.

642. There are ingenious exposure tables gotten up by different parties to give the time required, considering all these circumstances, but, while they may be of some value

and assistance to the operator, a great deal depends on his judgment and experience, which can only be acquired by continued practice.

643. In exposing a plate, probably the best guide is the image upon the ground-glass, as seen under the focusing cloth. By examining the strength of the image, the operator will be able to judge the necessary exposure if he knows the sensitiveness of the plate he is using.

644. It will require but a few trial exposures to determine the one sufficiently accurate for good results, and in determining future exposures the results of preliminary exposures may be taken as a basis. The time of year, time of day and general conditions of light must be considered.

645. The old adage, expose for detail in the shadows and let the high-lights take care of themselves, is a good one, but like most other good things, must be used with discretion.

646. Exercise your best judgment in determining exposures, and keep a record of each exposure made, as this will be a great help in determining future exposures.

CHAPTER XXVIII.

Practical Use of the Camera.

Architectural and Landscape Photography for Beginners.

647. The object of this chapter is to encourage the beginner to improve his work by diligent and intelligent effort and to urge him take pictures of a high standard of excellence only. The first step is the choice of a subject for the picture. Naturally, street scenes suggest themselves in this connection, and in these, buildings will necessarily figure very largely. So we have, then, our first experience with Architectural Photography. Now, in every architectural picture the first and most necessary requirement is true and perfect perspective. Perspective is the art of representing objects on a plane surface so that the picture will present the same appearance as the object itself when viewed from a given point.

648. Now the lens does not always see the object as the human eye sees it. This is often the case with uncorrected lenses, where the lens is at variance with the normal angle of vision, and the result is a perspective that is untruthful and displeasing to the trained eye. The photographer has then to consider three things in making a picture of this kind: The horizon line in the picture, the relation of the point of view to the sides of the building, and the proximity of the view point to the object. A low horizon line, for instance, tends to heighten a building,

while a high one tends to lower and flatten it. However, if you desire to emphasize the height of a building, choose a low horizon line. Furthermore, in selecting the point of view, it should never be directly in front of the building, nor should the picture show equal portions of the front or side. The point of view had best be a little to one side—right or left of the front—to show the mouldings and the ornaments. In general, the view point should be placed at a distance of about three times the height of the building. If the picture is taken nearer, sharp and vanishing lines occur that cause distortion.

649. In Ill. No. 69 is shown a church photographed from the proper distance, and gives a most pleasing effect. In Ill. No. 70 we have a low horizon line, since the object is to emphasize the size and mass of the school building.

650. In both these pictures the lines and proportions of the buildings are admirably reproduced in the photographic prints. Work of this kind is always its own reward. They are excellent examples of good architectural views taken by beginners.

651. The street scene in Ill. No. 71 is likewise a good example of linear perspective and lighting. Being a time exposure, the camera was set upon the shady side of the street, in such a way that the angle of vision extended up the street as far as the eye could reach. The picture is not only a record of fact, but it also gives one an excellent idea of the length and breadth of the street as a main thoroughfare.

652. From street scenes, the next step is naturally to landscape photography. The study of landscape is not only a source of pleasure to the amateur or beginner in photography, but it is likewise a source of education to

Illustration No. 69
See Paragraph No. 649

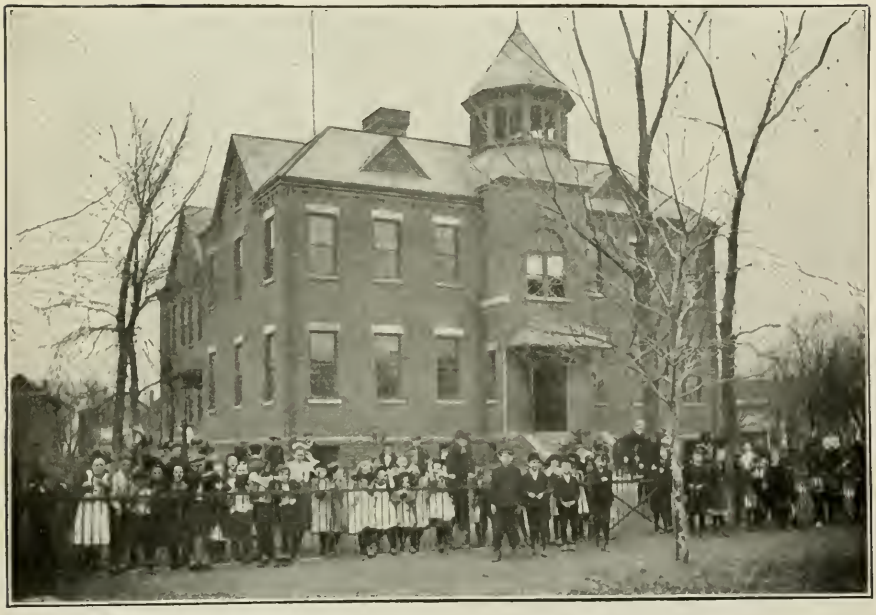


Illustration No. 70
Low Horizon Line Emphasizing Size of Building
See Paragraph No. 649

Illustration No. 71—See Paragraph 651

Illustration No. 72—See Paragraph No. 654

him in his chosen art. Apart from its pleasures there are many technical uses to which the knowledge thus acquired may be applied. The beginner will make his own application of it as suits his interests best. The chief difficulty in this work comes from inability to see the essential elements in the view, or having seen them, in not being able to reproduce them in his picture.

653. There are several essentials that constitute the life of any landscape. First, unity—that is, there must be a central point of interest toward which all lines and all other objects in the picture tend. When this has been selected, everything else in the picture should be subordinated to it. If there are several objects in the picture they should one and all express the same central idea. Any object not directly connected with the principal object should not only be subordinated but, if possible, excluded from the picture altogether. This may be accomplished by putting it out of focus, throwing it into the background, or directing attention to the principal object in the picture by the lines of the composition.

654. The next essential in the landscape should be variety, i. e., there should be variety in the unity of the picture. This brings up the question of composition, the most important question perhaps in landscape photography. In Ill. No. 72 we have an ordinary landscape such as a beginner might make. The picture itself shows thought and intelligent handling on the part of its author. The central point of interest is the winding roadway that leads up into the picture. There is good perspective and the grass and shrubs in the foreground are given importance because the point of view for the camera was low, compressing the ground plans and emphasizing the foreground.

The handling of the various masses of light and shade is fairly good, while the decorative effect of the tree on the left of the picture is pleasingly introduced. There is detail in these shadows, showing that the camerist exposed for the shadows, leaving the lights to take care of themselves, a good rule to follow in exposure for landscapes generally.

655. In Ill. No. 73 we have another type of open air picture, where the landscape is used only as a setting for the portrait or figure study of a girl. The entire point of interest here is a girl plucking a rose. The idea is an excellent one and the lighting and technique are good. Furthermore, as a record of fact it is no doubt true to nature, but as the expression of an idea it is lacking in idealization. The rosebush is, perhaps, too prominent and divides attenton with the girl, while the pose of the girl on the edge of the pathway, facing the camera full front, with her arm behind her back, is too artificial to say the least. A side view of the girl looking at the roses would be more natural, and by getting back twice the distance from the subject, with the camera, the view would be in better proportion and the figure would not appear so crowded in the picture. Simplicity is the keynote to success in picture making. Learn rather to leave things out, and how to put one thing into the photograph well.

656. In Ill. 74 we have a nondescript print lacking in the first essential for a good picture, viz., unity. There is no one idea expressed by this photograph. It is neither a marine nor a landscape. Because the view point was too low down, the rocks in the foreground were exaggerated and hide the sea. The tree, though graceful and decorative in itself, is an excrescence here, and hideously out of place. Objects that are proper in one set of surroundings may not

Illustration No. 73
Landscape
Setting
for
Portrait Study

See Paragraph
No. 655

Illustration
No. 74
A Photograph
Which Lacks the
Expression of
An Idea

See Paragraph
No. 656

Illustration No. 75
A Marine Snap Shot
See Paragraph No. 657

be suitable to another. This applies also to the human figure arranged in this picture, for while a figure in a landscape gives a touch of human interest to the picture, it does not mix readily with landscape accessories. In this picture the standing lady is a discordant note. Had the photographer gone up the beach further and got the sweep of shore line in his picture, he would have improved it very materially. Trimming an inch off the foreground would help still further to center the interest, but the picture as a whole is a good example of what the beginner should not do in picture making. There is a certain amount of attention due to propriety and the fitness of things in photography as in everything else.

657. In Ill. No. 75 we have what is technically known as a marine snap-shot. It was a rapid exposure of a moving steamship. It was almost impossible to focus it on the ground-glass because it was rapidly moving away, and it was equally impossible to expose the plate for any length of time for the same reason. Yet, the result is a fine negative technically, both of the ship and the churning water in its wake. When the lines were being cast off, and the boat was ready to start, in fancy we can see the photographer setting his hand camera upon a tripod and proceeding to focus on the ground-glass. The wind was blowing strongly and he focused on the paddle wheel because it was stationary. When it began to revolve he closed the shutter and adjusted the speed quickly. It was a dark subject for a snap-shot, yet the water in foreground was much agitated and the steamer quivered all over with motion that threatened to blur the picture and spoil it. He, therefore, tried a compromise and gave the view a 1-25 second exposure. This exposure was quick enough to show

the motion of the water and was long enough to bring out the details of the ship. There is but one defect, and that is the direction of the boat headed out of the picture. Otherwise, the result is a technically fine marine snap-shot.

658. In Ill. No. 76 we have a picture of a moving tug boat. Here the direction of the boat is more pleasing. It is difficult to keep it in focus, however, because the boat is moving towards the camera all the time. We close the shutter and place the index above the lens at 1-50, leaving the diaphragm at 8. We insert the plate holder and set the shutter. When the tug has reached a point about 200 ft. away from the camera we press the bulb and snap the picture. Most exposures of this kind are guess work, in a certain sense, but guess work based on experience. Time and experience will teach us the proper exposure, and there is no other method by which the beginner can acquire it too readily and so well. Everything depends on the nature of the view and the kind of light we work in.

659. Most of the unsatisfactory work in photographing landscapes is due to ignorance of composition and right manipulation of the print. Composition deals first with the grouping of objects—the relation of masses—the distribution of light and shade, and the direction of lines in the picture. Take Ill. No. 77 as an example. Examine the trees that crowd the picture. The central point of interest is the running brook, which is the chief feature of the picture. Instead of making the water prominent, it has been thrown back and dwarfed by the obtruding tree trunks in the foreground. It is the usual mistake of the beginner, trying to put too many things into the picture. Trimming at least an inch off the foreground would lessen this defect. Furthermore, an important rule is that the lines of the com-

Illustration No. 76
Importance of Position in Snap Shots
See Paragraph No. 658

Illustration No. 77
Example of Faulty Composition
See Paragraph No. 659

Illustration No. 78
A Pleasing Landscape Study
See Paragraph No. 662

position should direct attention to the principal object subordinating other details. The lines in this picture are outside the principal object and too far away from it. The composition is really dominated by these parallel lines of tree trunks, which are unduly prominent and make up the composition. More than this, instead of giving perspective to the composition, they are perpendicular and parallel to the plane of the plate, which is also contrary to all the rules of composition. There is certainly no feeling for atmosphere in this picture, and a landscape without atmosphere is unbearable. It is one of several proofs that make this picture the work of a novice. The short exposure of the snap-shot method accounts for this. On the whole, we regard this picture as a lesson to the beginner on what not to do.

660. In order to get pictorial quality in a landscape and marine work, the average beginner must have an intimate knowledge of nature as well as an understanding of photographic techique. It is the expression of this rather than the recording effects that must be tried for in the picture. With good ideas and a right command of the medium, results should crystallize into form in the picture produced.

661. A photographer, whether he is a beginner or an advanced worker, will always put something of his individuality into any picture that he makes. Individuality should be seen in this and be just as much a part of the picture as the trees, the shrubbery, or the winding brook. The value of this quality in his work reveals the man and tells us something of his personality. The picture ceases to be a mere winding brook, with trees and shrubbery for a setting; it is really his interpretation of that fact. We

not only see the view but we see it through his eyes and he gives us a chance to experience the same feelings of pleasure and admiration that stirred him at the sight. Such a man is usually a careful and methodical worker, and moves deliberately. If he is careless and slovenly you cannot expect to make a picture that will interpret such subtle and elusive elements as the motives and feelings of a man's soul.

662. In Ill. No. 78 we have a pleasing landscape study, that is something more than a mere record of fact. In it one sees the beautiful things that might escape the ordinary observer, if this particular photographer had not made it. The water way, the stone bridge set down amid the foliage and the trees in a soft sunlight, make a quiet, peaceful landscape full of poetry and grace. The low horizon in the sky line gives the effect of distance in the picture. In every complete landscape there is the foreground, the middle distance and the background. The rule is that the foreground must always be in focus. The detail there should be reasonably sharp, while the middle distance is sharp only when the foreground has been cut off. The background is always out of focus, and without detail. The tall trees in the foreground here are sharply in focus and most decorative. But the out of focus background in the picture gives it the feeling of atmosphere. It also emphasizes the lines in the picture, the undulating banks of the water way and the graceful lines of the foliage leading up to the bridge, the central point of interest. When this rule is overlooked, the composition is sure to suffer and the picture will be bad. Again, the lighting here is very soft and pleasing, and evenly distributed all over the print. Too bright an illumination, thoroughly diffused, and with-

out shadows is bad. Shadows naturally follow the light, and are the life and color of any landscape. In this particular view, the shadows are transparent, i. e., have detail in them showing that the exposure was all right. Of course, the development is also included in this and is a strong factor in securing successful shadows. On the whole, this picture is a fine example of the possibilities of photography in the hands of a serious minded beginner, who wants to secure the best results attainable with the camera.

CHAPTER XXIX.

Elementary Snow Photography.

663. In making snow pictures, aside from the selection of view the principal secret lies in the proper exposure and the angle of light. Early in the forenoon, before 9 o'clock, or in the afternoon after 2 o'clock, will give you excellent angles. The very best results are obtained early in the morning, when the shadows are long. As the white snow supplies a strong reflector, exposure will necessarily be very much shortened. Snow pictures can be successfully made only in bright sunlight, as you must have some high-lights and shadows, even in the pure white snow. Therefore, the angle of light at which the sun falls upon the objects in the snow (producing long or short shadows) has much to do with the success of the view.

664. In making pictures with snow on the ground, the exposure must be made in bright sunlight, and the time necessary for the exposure would be one-half of the exposure given under ordinary conditions. For instance, if you were making an exposure under ordinary conditions, giving 1-25th of a second, the same view made with snow on the ground must be made in half the time, or 1-50th of a second. Should the sun be obscured, it would be difficult to secure an interesting picture. If pictures must be made with a cloudy sky and snow on the ground, the exposure given should never be more than half of that required

for pictures of the same scene without snow. You must remember that we do not see light, light enables us to see. The plate is made sensitive to light, for the simple reason that light is the only agent that can and does record the image on the plate. Therefore, with a sharp focus of the object, a normal exposure and proper development, a negative should result which will represent the contrast of light and shade exactly as it is in the view.

665. It will be well to remember that when making pictures with snow on the ground, and in bright sunlight, the angle of the sunlight should never be towards the camera, even when coming from one side, but should be directed towards the object you are photographing, as the reflection from the snow is always thrown in the same direction in which the rays of the sun travel. If this direction is towards the object you are photographing, the object will be strongly illuminated by the reflection. If it should be toward the lens, then the plate, through the lens, receives the flood of reflected light, thus causing fog.

666. Even with the sun at the correct angle there will appear, by prolonged exposure, a certain amount of strong light between the object you are photographing and the lens. The distance is sure to be obliterated and your shadows will have little or no detail, unless some means are available for reducing the activity of the strong reflection of the sunlight upon the snow. Under ordinary conditions (without snow on the ground), if you desired to produce more detail, you would prolong the exposure and thereby secure detail in the shadows; but with snow on the ground, prolonged exposure to any great extent would be of no avail, because the strong reflection from the snow would cause a curtain of strong light between the lens and the

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Study No. 11—See Page 372

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object you are photographing. This curtain would reflect stronger light upon the plate than the actual light visible on the object to be photographed.

667. The sensitized plate is always attracted by the strongest lights first, whether reflected or direct, and in consequence the more subdued lights are left very hazy and misty in the shadows, so the only way this haze and mist can be overcome is by quick exposure.

668. Strong sunlight on the white snow, especially where the sun faces the instrument, will have the same effect upon the lens and plate as it would upon the human eye, when looking at the snow with the sun shining on it. In the latter case, the eyes are weakened and almost blinded by the dazzling white light. By looking across a plain of snow at some distant object, with the sun shining toward you, you would scarcely see the object, and the longer you look the less you can see. This is exactly what happens to the sensitized plate through the lens, so that the longer the exposure, under the named conditions, the less the lens will see. The result is that you have little detail on your exposed plate, and, like the human eye, the plate will have fogged over and the image will appear veiled.

669. You will observe when you first glance at the snow, even with the sun at one side instead of facing you, your vision is clear and you can see all the detail. After a second or so, however, the eyes weaken by the blazing light. Therefore, the short exposure on your plate will give you the same results and you will get plenty of detail, while with a longer exposure you get fog.

670. By the use of a ray filter, which is a specially prepared colored glass and can be fitted over the front of any ordinary lens, the activity of this curtain of strong light

(the reflection of the sun on the snow) will be reduced enough to give a good rendering in the negative in the amount of high-lights and the detail in the shadows. This ray filter has the same effect upon the plate as a pair of smoked or blue glasses would have over the eyes, for with them we would be able to look at the sun a long time without straining the eyes. With a ray filter longer exposure may be given the plate, if necessary, without fog. The color of the ray filter should be light amber. This will act on the lens as the glasses would on the eyes. By giving a slightly longer exposure when using the ray filter, you will preserve the detail in the foreground and at the same time have detail in the shadows.

671. There are many good ray filters on the market and they are inexpensive. They can be obtained from any dealer in photographic supplies. In ordering ray filters always be sure to give the exact outside measurement of the lens the filter is to fit over.

672. For an ordinary landscape in winter, a view point must be selected that will give good shadows. The light should come from one side and not directly back of you. A low sun is preferable, as it supplies long shadows; therefore, the best effects will be obtained early in the morning or late in the afternoon. A very quick exposure must be given, for the shadows are fully illuminated by the reflection from the snow. A smaller stop can be used for snow pictures than other views, the reflection of light being so much greater. The immediate foreground of a snow scene must be broken up with some dark objects—anything that will supply shadows or dark spots. A few tracks on a level expanse of snow will give some shadow and add greatly to the effect.

673. Some very picturesque scenes can frequently be obtained after a heavy fall of snow. Places, which ordinarily would be anything but attractive, make very pretty pictures with snow on the ground. Snow pictures, to be interesting, must always have some objects that will throw shadows, in order to break the mass of white. For example, take an old rail fence loaded with snow, along a driveway; the shadows from the old rails upon the snow give a pretty effect. For another, take a roadway with low shrubbery along the banks, limbs of trees covered with snow. The contrast between the dead black trees, the shrubbery and the snow, makes them appear really beautiful. Again, we have an open field, a single log hut or an old barn, a corn crib in the barn-yard, all of which make interesting pictures if they are photographed with the proper light to produce long shadows.

674. **Lens.**—Attention must be given to the lens during frosty weather. See that it does not scum over by the condensing of moisture in the air. This will occur on very cold days and when first taking the camera from the case. After the lens has been exposed for a short time so that it has the same temperature as the air, it will clear up. In order to avoid reflections from the snow into the lens, you can make a cone of black pasteboard and fit it around the underside of the lens tube, or holding the slide of the plate holder or any opaque substance under the lens (not too close to cut off any of the view) will prevent reflections. Reflections will not always occur, much depending upon the angle of light of the view. The reflection can, of course, be detected upon the ground-glass when focusing, and should it appear, it can be overcome by applying the above methods.

675. **Developing.**—To develop snow scenes use the ordinary developing formula, diluting one-third with water, being careful of the temperature. Remember that the best chemical action takes place at 65° Fahr. Develop for softness, but carry the development a trifle farther than you would ordinarily, thereby producing a little more density. In this way pure white snow is secured. Never undertake to develop the negatives when they are chilled and cold, as they will develop flat and even worse than a greatly over-timed exposure.

676. If the ground is covered with snow when preparing architectural or landscape lessons, you will need to apply the rules governing the necessary exposure given in this lesson, and time accordingly. It is advisable for your first experience with snow photography, that you make at least two exposures of the same scene. The results in developing the first will enable you to judge how to develop the second. Proof prints should be made from both plates, on the back of which should be noted all data pertaining to the producing of the results. These prints should be dated and filed in the proof file, for future reference.

CHAPTER XXX.

Elementary Flashlight Photography.

677. Frequently it is desired to make a photograph of an improperly lighted interior. The problem, then, is to secure even illumination and, at the same time, procure detail in the deepest shadows of certain portions. Perhaps there will be but one window in the room, and you might wish to point the camera directly toward it in order to photograph certain objects in that particular part of the room. It would, of course, be necessary, if using daylight, to have the curtains raised and allow the light to enter here. But for average work it would be almost impossible to secure proper results by pointing the camera directly towards the source of light. There may be other difficulties besides, which would not permit you to secure the desired results by using daylight as your illuminant. In such cases *you can resort to artificial light.* The best and most convenient to employ is **flashlight.** There are many methods of using this artificial light, the two ordinarly employed being flash-powder and flash-sheets.

678. For many purposes flashlight is more desirable than sunlight. If properly handled it can always be depended upon to give illumination when wanted. With it you will be able to secure just the right amount of brilliancy. It can also be so placed that the shadows will fall in the desired direction. To the amateur worker especially, flash-

light photography is a special convenience, and as photographic work is frequently confined to the night, he should by all means understand its use.

679. It is frequently desirable to photograph a large room which is illuminated by only one small source of light. Again, to secure a full time exposure in the darkest corner of the room would cause a decided over-exposure near the window. The flash-powder may be placed in such a position that it will illuminate this dark corner, being so concealed by some article of furniture or a screen, that it does not strike the lens. These ordinary uses of the flashlight will enable any amateur to secure successful results; in fact be equal, if not superior, to the ordinary snap-shots out of doors.

680. **Flash-Powder.**—Flash-powder is put up in various ways—it is usually supplied in one ounce bottles or boxes. Perhaps the most popular brands of flash-powder (yet all are good) are the Luxo, the Nichols, the Victor and the Eastman. The latter company also put up what is known as flashlight cartridges, which have a fuse attached to the cartridge for igniting them. Each cartridge contains a certain amount of powder. When a large flash is required, more than one cartridge may be employed. They also supply what is known as flash-sheets, which are used by simply pinning them up against a cardboard on the wall and igniting the lower corner. (See Paragraph 685.)

681. **Caution.**—Flash-powder is just exactly as dangerous to handle as gun-powder. It must be kept away from heat. Friction will sometimes ignite it; therefore, be very careful in handling it. Flash-powder must never be used in a magnesium lamp, for with this lamp the mag-

nesium is stored in a chamber and, through a rubber tube, blown into the flame. If flash-powder were used in this machine you would have an explosion. We give these cautions so that you will not meet with accident, yet there is practically no danger if these precautions are observed.

682. **Preparing the Flash-Powder.**—There are different ways of operating or igniting the flash-powder. The most convenient for amateur use, however, are either the flash cartridges or flash-sheets, the latter of which are used by simply pinning them up against a cardboard on the wall and igniting the lower corner. The same general principles will apply whether the lamp, the cartridge, or the flash-sheet be used. Another simple method, where Luxo or other flash-powders are used, and where you have no machine for igniting the powder, is to use an ordinary flat tin pan.

683. To prepare Luxo or other bulk powders for flashlight, when a flat pan is used, place a little cotton batting or absorbent cotton on a pan (one with a handle preferred). Pour sufficient Luxo, or whatever powder you use, on the cotton, well scattered. Allow a small piece of the cotton to hang over the edge of the pan, say five to seven inches. Use this as a fuse for igniting and setting off the flashlight. When you are ready, place the pan on a table or step-ladder, and light the end of the cotton with a match or lighted candle. Always light the fuse from below, never from above. Do not look into the flash, but as soon as you light the fuse turn your face away from the powder, as it is very dazzling and extremely hot.

684. **Placing the Flashlight.**—The light should always be placed two feet behind and two or three feet to one side of the camera. It is very essential to avoid having the

flash come into the field of the lens, which would blur the picture. This would be the case if it were placed in front of or even on a line with the front of the camera. It should be placed to one side, as well as behind, so as to throw a slight shadow and give a little relief in lighting. It is best to have the flash a little higher than the camera. A sheet of white cardboard may be set up a couple feet behind the flash, and as this will act as a reflector the strength of the light will be increased.

685. **Flash-Sheet.**—Pin a flash-sheet by one corner to a piece of cardboard, which has previously been fixed in a perpendicular position. If the cardboard is white it will act as a reflector. Now, having the camera and the powder in position, open the shutter of the camera as for time exposure, using the stop ordinarily employed for snap-shots. Stand at arm's length and touch a match to the lower corner of the flash-sheet. As soon as the flash is over, close the shutter.

686. If it is necessary to use two or more sheets, they should be pinned to the cardboard, one above the other, the corners slightly over-lapping. As a matter of precaution, place a piece of cardboard beneath, as well as one behind, the flash-sheet. If a piece of burning powder should fall, it will then do no injury.

687. **Flash Cartridges.**—Remove the cover and rubber band from the cartridge and place it upon a cardboard. Now, open the shutter, ignite the fuse while at arm's length, protecting the eyes, in the meantime, from the brilliant flash. After the flash close the shutter. If two cartridges are required, the contents of one of them can be poured into the other, care being taken, however, that if any of the powder spills off it does not lie in such a

position as to practically shorten the fuse. The fuses work very quickly; therefore you should be very careful to get away before the flash goes off. Never stand with your face over the powder, nor even have your hand above the powder. When the flash takes place the flame shoots upward; therefore, if you keep below the flash there will be much less danger. Do not become excited or nervous, as there is no need of it. You should work carefully, and by observing the above cautions there will be absolutely no danger.

688. **Flash-Lamp.**—There are various flash-lamps that may be purchased at prices ranging from $1.00 up. These will be found to give excellent satisfaction and there is less danger in employing them. The Nichols, Jr. lamp, which sells for $7.50, is the most practical low priced amateur lamp on the market. There are hand lamps, however, which may be purchased for $1.00 or $1.50, that will give equal results.

689. **The Powder.**—The amount of powder required to light a room depends entirely upon the color of the walls and hangings, as well as the distance of the object furthest from the camera. The following table, based on the Eastman flash cartridge, is approximately correct when using the ordinary hand camera or kodak with the lens wide open:

690. **Table.**—

TABLE.

For 10 feet distance and light walls and hangings use	1 Cartridge No. 2, or 1 even teaspoonful 1 Flash Sheet.
For 10 feet distance and dark walls and hangings use	2 Cartridges No. 2, or 2 even teaspoonsful 2 Flash Sheets.
For 15 feet distance and light walls and hangings use	2 Cartridges No. 2, or 2 even teaspoonsful 2 Flash Sheets.

For 15 feet distance and dark walls and hangings use { 3 Cartridges No. 2, or 3 even teaspoonsful 3 Flash Sheets.

For 25 feet distance and light walls and hangings use { 3 Cartridges No. 2, or 3 even teaspoonsful 3 Flash Sheets.

For 25 feet distance and dark walls and hangings use { 4 Cartridges No. 2, or 4 even teaspoonsful 4 Flash Sheets.

Note.—The No. 1 Cartridges hold 50% more powder and the No. 3 about half as much as the No. 2 and should be used accordingly.

691. **Portraits.**—Place the sitter in a chair partly facing the camera, and turn the face slightly towards the camera, which latter should be at the height of an ordinary table. The proper distance from the camera to the subject will depend upon the size of image you wish to produce. This may be ascertained by looking at the image in the finder. The subject should not be arranged facing the flash, but the figure and face should be slightly turned from the light.

692. **Groups.**—Groups should be arranged in a semi-circular form, facing the camera. Each member of the group should be exactly the same distance from the camera. In case of groups of a dozen or more members some of them may be seated, others may be arranged standing. Usually the tall members appear best in a sitting or lounging position. If it is necessary that any of the subjects be seated on the floor, the legs should be drawn in closely—not extended toward the camera.

693. **Important.**—It is always best to have the room well lighted when making flashlights. Especially is this advisable when making portraits or groups, for if the room is darkened the sudden flash of the powder so strains the eyes of the sitters that they almost invariably have

a staring look. On the other hand, if the room is already well illuminated by electric or lamp light, the strain will not be great and the eyes will have a natural expression. When the room is brightly lighted, however, the shutter should not be opened until just an instant before the flash is made. It must also be closed immediately after the flash.

694. When more than one flashlight is to be taken the windows should be opened and time allowed between each flash to free the room thoroughly from smoke. If this precaution is not taken, those pictures which are made while there is smoke in the room will have a foggy appearance. No matter how little smoke there is in the room it may cause a fogged negative, as the lens is even keener than the eye in detecting it.

695. The flash-sheets are not instantaneous, and, therefore, when making portraits or groups you should request your subject to remain still, just the same as for a time exposure. The flash-sheets are best to use when photographing general interior views in which there are no moving objects. From one to two seconds are consumed in burning a single flash-sheet, and the light is much less brilliant than the instantaneous flash. This is a decided advantage when the subjects can be depended upon to keep quiet, as the eyes are not strained by the flash and do not have the staring effect so often seen in flashlight pictures. In photographing children or groups it is better to use the flash-cartridge, or the flash-lamp, as either of these methods is practically instantaneous.

696. **Development.**—When developing negatives that have been made by flashlight, you should keep them as far from the ruby light as possible. In fact, it is advisable to shade them from the rays of the ruby light. The reason

for this is that the image will not appear as quickly on such negatives as on those made by daylight. Development might proceed a little slowly, but you should judge completed development in exactly the same manner as you would ordinary exposures made in daylight.

697. **Practice Work.**—It is advisable for your first practice work to use the minimum amount of powder given in the scale, and if upon developing the plate you find it under-exposed, you will understand that more powder must be used, when working under the same circumstances, and the exact additional amount must be estimated by the appearance of the quality of the negative first developed. For your first experiments it is advisable to select the interior of a room, locating your camera so as to take in as much of the room as possible; then arrange your flashlight ready for the exposure.

698. Above all things when handling flash-powder, whether in sheets, cartridges, with a flash-machine, or an ordinary tin pan, *keep cool, work carefully,* and *never hold your hands or face over the powder at any time.* When all is in readiness, first press the bulb and open the shutter, and with a lighted match or candle (usually a tape is used) light the fuse. As soon as you have done so turn the face from the light, looking into the direction of the view of the room, to observe the effect of the illumination. As soon as the exposure is made close the shutter or cap the lens.

699. With a little experience you will be able to work the flashlight as well as daylight, even with groups and portraits in the home. When developing flashlight plates use diluted developer, and carry the plate to a good strength. Make proof prints from each experiment, noting on the

back of each all data concerning the manner of procedure, such as the amount of powder, the size of stop used, size of room you are working in, color of the surroundings, method of igniting the powder, etc. File all proofs containing data in your proof file, for future reference.

CHAPTER XXXI.

The Evolution of the Dark-Room from a Bath-Room.

By Richard Hines, Jr.

THE dark-room of the average amateur is a work of evolution, and it is not hard, after a look into the dark-room to come very near judging the manner of the amateur who inhabits it.

My own experience in this matter of evolution may be interesting to those who have but lately begun their climb up the photographic ladder, and before whom there are now appearing bright visions of salon honors some time in the future. My photographic birth, so to speak, took place in the family bath-room, where I sat and sweltered during spare afternoons and nights in an effort to coax an image out of some little square pieces of glass, covered with a creamy white substance, which seemed to have a most persistent habit of turning black as ink almost the minute the developing solution was poured on. At first there were no conveniences in that dark-room beyond the running water from the tap. Finally, a little cabinet, to go up against the wall, was thought out, and a carpenter was consulted. He was given the idea, which he materialized into a developing cabinet, for one dollar and a half in the coin of the realm. This cabinet was supported on brackets and screwed into the wall of the bath-room. It had three shelves, and the cross-pieces, which supported the shelves,

fitted into notched places on the side, like the shelves of a bookcase, so that the distance between the shelves was optional. The door, or lid, of this cabinet closed perpendicularly, just like some of the writing desks you have seen, and when it was down it formed a table, on which were placed the developing trays, while the little developing lamp found a place back in the cabinet. Many a dollar's worth of plates and films was wasted at the shrine of that cabinet; but that was not the fault of the cabinet, and through all these years of photographic trials and tribulations, with an occasional triumph that little cabinet has done duty. The bath-room in which it was first put up was so small, that there was not room enough for a chair in front of it; so a plank was placed across the bath tub and used as a seat.

Later I got into larger quarters, with plenty of room, and that little cabinet still rests against the west end of the dark-room, though it is not used as much as formerly. I have wearied of prolonged sessions in a closed dark-room, and this weariness set me thinking, and the thinking brought about both the evolution and the emancipation from the confines of a closed room full of stifling air. In this matter of photography, each man is a law unto himself as to when he does it, where he does it, and how he does it. The environment of each of us generally settles that matter. It did with me.

I found very little occasion for the use of a dark-room in the daytime, and, as the nights down here are dark enough to protect the photographic plate from fog, I determined to give the dark-room a rest, and convert my den, adjoining, into an all-round workroom—dark, and otherwise.

I procured an ordinary kitchen table, of yellow pine,

SNOW SCENE

STUDY NO. 12

BY S. L. CARPENTER

3x4 feet, which I padded with old newspapers, so that any glass belongings that might accidentally get knocked over would not break because of the paper buffer and then covered this with white oilcloth it being easily wiped off and showing the least dust or dirt. This rests against the west wall of the room, and fits snugly between the west windows of the room. The Carbutt's Lantern occupies the southwest corner of this table, with its 8x10 glass front, facing north. The iron framework of the corner of the lamp thus placed throws a shadow over the central portion of the table, where the developing is done. Three white porcelain trays, 7x9, occupy the center of the table, and to the right the operator sits at the table; facing west are two 8x10 deep orange glass trays. On the northwest corner sits the fixing box. Lined against the wall are a few bottles of developer filled to the brim, and with corks paraffined, though the practice of making up much developer at a time is not followed. Usually all developers are made up freshly, used right away, and then thrown out. Saving old developers I have found to be poor economy. To the right of the center of the table are four graduates—one 8 ozs., one 4 ozs. one minim., and one 100 cc. There are also glass stirring rods, a thermometer, and a palette knife. The illuminant used is a 16 c. p. incandescent electric light. This is fitted into a wooden base, about two inches thick and four inches square, so that the glass bulb stands upright, and the lamp, attached to an ample supply of wire, can be carried to any point of the room, just like an oil lamp. When developing, this lamp is placed inside the dark-room lamp but when not so used, its place is on the southeast corner of the table, where along the edges there are marked measured spaces, from 6 to 18 inches from

the center of the light, for use in gaslight paper printing. From a pasteboard tube, such as is used in mailing, I have made a very handy little arrangement for printing gaslight paper. A section of the tube, which stands about 4 to 6 inches above the top of the electric light bulb, was cut, and after ascertaining that portion of the tube corresponding to the length of the incandescent bulb, that was cut out around one-half of the circumference of the tube, and the opening so made was covered with four thicknesses of orange tissue paper. When printing gaslight paper, this is placed over the light while loading the frames, then slipped off and the exposure made, being replaced when the time of exposure has expired, and allowed to remain during the development of the paper. It is one of the greatest conveniences on the table, and is alike useful when making lantern slides. So far I have found it perfectly safe, and neither slides nor gaslight paper handled under it have shown any signs of fog. If even greater precaution is deemed necessary, the tube can be turned, presenting the pasteboard side to that portion of the table where the sensitive material is being handled, thus reducing the light to the minimum.

These are the main features of this table, which has taken the place of an enclosed dark-room. There are many other things on the table, such as ruby varnish for backing plates, bromide solution, tissue papers of three colors, mats, and the like; for, be it known, that this table is used for developing, printing, lantern-slide making as well as finishing, *passe partout* work, and in fact *all* the various branches of photography in which I am interested. There is no running water, and to this I attribute the cleanliness that necessarily has to be observed. Underneath the table

is a large bucket for slops, and also a large pitcher, which holds a couple gallons of water. These are only for immediate use, as, after fixing, all negatives and lantern slides are placed in washing boxes and taken to the kitchen sink, where they are thoroughly washed. The same method is observed with prints. The front half of the table is amply protected with blotters and old papers, so that any solutions accidentally spilled are taken up before they reach the white oilcloth underneath.

When any process is completed, all dishes, trays, and utensils used are at once thoroughly cleaned before being put up, and then before use again they are thoroughly rinsed in clean water.

On this table there is a place for everything, and I can go in the room in the dark and put my hand on anything I want. To any one other than the user, there is no doubt it would appear to be little less than a photographic pandemonium.

I formerly pursued a different method. In another room I had a place for everything, and everything in its place; but, when I had a little time to devote to photography, I found that before I could get all the needful things assembled and ready to start that my time had flown, and that I had to get back to real work. Now, I go right into this all-round den and dark-room, and immediately I sit down to the table, everything I want for any process, whether it be developing negatives, or printing gaslight prints, or making lantern slides, is right there to my hand, and all I have to do is to pick them up and go to work, utilizing my time in doing something, rather than in getting ready to prepare to begin to do something.

This table, which I have tried to describe, occupies

about one-half of the west side of the room. Half of the north wall is taken up with a set of shelves, which hold part of my photographic library, many negatives, chemicals, and other conveniences. The other half is a kind of background carrier, and in front of the backgrounds is a screen about 6x8, which is used both as a reflector and to show lantern-slides at home. On the east side of this den is a comfortable lounge, where, undisturbed, the writer often takes a short afternoon nap, to fit him for his all-night vigil, which usually ends about 3.30 A. M. On the south side is a fireplace, with coal grate, and alongside of the grate a closet, where unbound magazines and other things are stored. On the east side of the grate is the door opening into the former dark rooms.

The windows of this den are hung with orange-colored shades, so that if it is desired to do any gaslight paper printing in the daytime, all that is necessary is to pull down the shades and close the door, when the light is perfectly safe, with ample illumination. In the summer months the windows are never closed, and as the room has a north-western exposure, there is almost always a breeze from the Gulf blowing into the room, so there is no lack of fresh air. If the room happens to get uncomfortably warm, an electric fan in one corner whirls a cooling current of air across the work table.

In this arrangement, which has been gradually evolved, I now find convenience, and, greatest of all—comfort.

CHAPTER XXXII.

My Dark-Room.

By Ulysses G. Orr.

OFTENTIMES the problem of fitting up a dark-room in the average home is troublesome in the extreme. As a compromise, the bath-room, some closet, or even the basement, is resorted to with anything but satisfactory results, not only to the amateur, but to the other occupants of the house, whose caustic remarks about monopolizing property in which equal rights are supposed to be vested do not help in the development of any negative, to say nothing of a balky, under-exposed one. A dark-room fitted up in the habitable part of the house is apt to be so unsightly, to any but enthusiastic eyes, that it is seldom attempted. It is just such a room that I wish to describe, so that others may enjoy the luxuries of a first-class room, without offending the aesthetic sensibilities of the less enthusiastic members of the household.

Any bed-room, or other convenient room, the larger the better, over which the amateur has undisputed sway, may be fitted up for use, and still be presentable for other occasions. The room I use is a dressing room opening off my bed-room. It is six and one-half feet by seven and one-half feet, and would be better larger, as the air would not foul so quickly; however, judicious ventilation has accomplished much to keep the air pure.

Illustration No. 79 shows the arrangement of the room, which is wainscoted on all sides, four feet high, with 7/8-inch matched ceiling, and this ceiling forms the doors to the cupboards, which extend across one side of the room

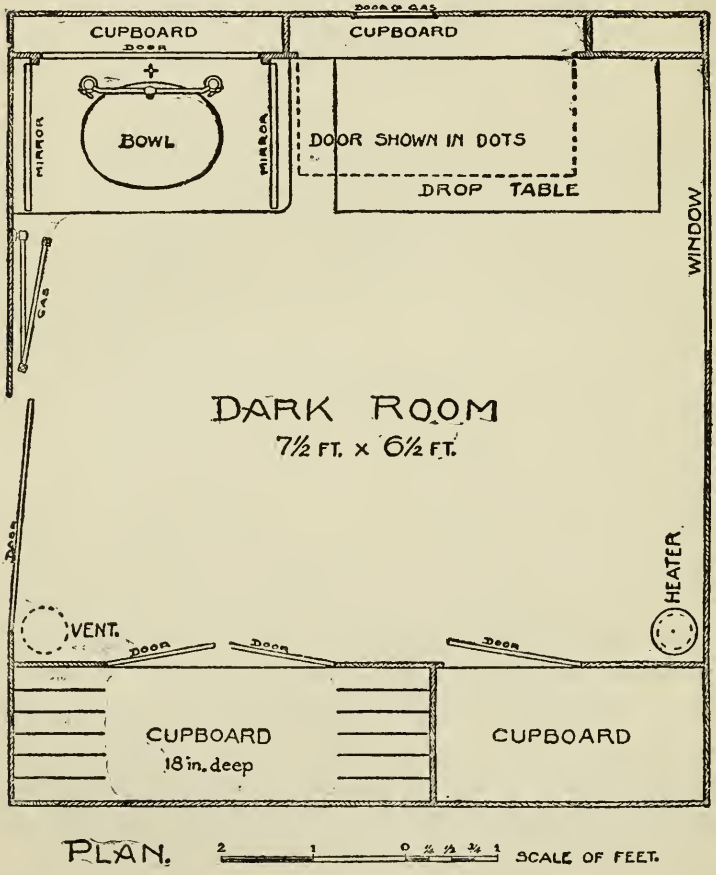

Illustration No. 79.

from the floor to the ceiling. The washstand is the ordinary marble stand, with a 15x9-inch oval bowl. The faucets are connected so as to form one outlet, which permits the water

to flow cold, hot, or mixed to any desired temperature. The waste is a metal plug at the bottom of the bowl, which operates by turning a lever on the marble slab back of the bowl. The overflow is what is known as the "Patent Overflow," the openings being at the top of the bowl in the back. This arrangement leaves an entirely free receptacle for washing prints or negatives, and the suction does not draw the prints down over the outlet, destroying them and overflowing the bowl, as is the case when the waste is at the bottom, and there is no chain to injure prints or negatives.

The drop table forms a convenient place for frames, holders, etc., as well as for other articles, when the room is being used as a dark-room, and it may be dropped out of the way when not required. It also supports the door to cupboard for developers and light. When closed it appears as ordinary wainscot; when open it forms the most convenient of places for developers, hypo, graduates, etc., used during development. The ruby light is also in this cupboard right where it is required for working negatives or bromide papers, and consists of an ordinary wall bracket gas jet in the room adjoining and opposite the glass. It is controlled by a cock in the dark-room, as well as at the fixture in the other room. It is so arranged that it can be swung away from the ruby glass and the glass covered by a small hinged door, so that it does not show in the adjoining room when the door is closed. The light can be turned up or down without leaving the chair while developing, and, not being in the dark-room, it does not vitiate the air there.

The outside window to the dark-room is obscured by simply raising the ordinary inside sliding blinds, which have

no revolving slats, but solid wood panels instead, so that the operation of converting the room into a dark-room is simple in the extreme. A dark-green window shade is placed between the window and sliding blind, and the brightest sunshine has no effect on this light-stopping combination. There is a tin panel in the lower section of the blind, at the proper height, opposite the drop table, in which a tin slide obscures the light during development. When enlarging, this slide is removed, the shade left up, and the camera, with focusing glass removed, attached to a tin frame which slides into place in the tin panel, when the room is the finest kind of an enlarging room, as the work is done in full view, where masking, cloud printing, and the numerous little dodges so useful in enlarging can be done freely, the bromide paper being tacked to a board which can be adjusted in any direction to get any degree of enlargement desired, all that is necessary being two T-shaped pieces of wood placed top down, and the board clamped to these at the desired height, then one of the supports is clamped to the table at the proper distance from the camera. The whole operation is so simple that enlarging is a pleasure. There is a small hole in the blind, covered with ruby glass, at a convenient height for looking out. Experience has demonstrated the necessity for some way of determining whether or not the sun continues bright or disappears under a cloud during the exposure, and this small window does the work nicely, as the shadows cast by the sun can be seen distinctly through the ruby glass.

Over the washstand is a cupboard having a mirror for a door and a swinging mirror each side of the door. This is used when printing gaslight papers. The large mirror in the center, which forms the door, is swung

out at right-angles and obscures the table from the light at the side of the door to the dark-room, when all of the operations of filling printing frames, developing and fixing, can be done with gas turned up full. The swinging mirror, at the left, is swung around in front of the cupboard and the printing frames hung to hooks on the back, the swinging gas bracket being adjusted to any desired distance from the frame.

At the rear of the room are a number of cupboards, so dear to the heart of every amateur, in which can be stored all requisite paraphernalia, negatives, etc., so that anything can be found in the dark if necessary. The arrangement of these cupboards would warrant a separate article but for the fact that each amateur has decided notions of his own as to filing negatives, keeping his stock and chemicals, the arrangement of drying closet, dark closet, tray racks, etc.

The room is ventilated in two places. Over the door, in the ceiling, is an opening from which an ordinary 6-inch stove pipe runs up and out of the roof with a ventilating cap on top. The pipe does not run straight up, but has an elbow to offset the pipe, and thus prevent direct rays from reaching the room. The opening at ceiling has a cover which can be drawn down to open ventilator, and is wide enough to prevent direct light rays from entering the room. Near the window is a small enclosed gas stove, which heats and ventilates in winter; the pipe acting as a vent-flue helps to ventilate in summer. There are a number of holes in the bottom of the door to admit a supply of fresh air.

It is a pleasure to go into a dark-room of this kind, knowing that you will not be disturbed, and that you have everything you will require right at hand.

CHAPTER XXXIII.

How the Studies Illustrating This Volume Were Made.

Frontispiece. Title, "Valambrosa," made in Florence, Italy, by Wm. H. Phillips, of Liverpool, Ohio. This picture was produced with a No. 3 Folding Pocket Kodak; the lens used was a Goerz 5-inch focus, Series III; the negative was made on a non-curling film, developed with pyro-soda developer. The film was enlarged to 14x17. Used royal bromide, printed with a white margin. The bromide was developed with rodinal strong solution—one part rodinal, 6 parts water. The print was mounted on a combination mount first chocolate narrow border with gray support.

Study No. 1. Title, "Street Performance," by Grace E. Mounts, of Morrow, Ohio. Picture was made about noon, in the month of September, with a slightly hazy sky. Lens used was Rectilinear, furnished with cartridge kodak; stop used, f-8. Negative was made on an Eastman film; exposure, instantaneous. Film was developed in the regular way, without any after manipulation. Print was made on Velox. (See Page 25).

Study No. 3. Title, "At the Seashore," by John S. Neary, of Trenton, N. J. This picture was made with an instantaneous pocket kodak, 3¼x4¼. The exposure was made at 11 A. M., on a bright summer day. Film was developed with pyro-soda developer, and printed on velvet

velox; mounted on a combination mount; first section neutral gray tint, second section, gray black. (See Page 111).

Study No. 4. Title, "Home, Sweet Home," by Grace E. Mounts, of Morrow, Ohio. This picture was made at 4:30 P. M., in the month of June, with a medium light, but not strong sunlight. The lens used was a Goerz Dagor, Series III, 6½-inch focus; stop used, No. 8. Negative was made on an Eastman film, with a No. 4 Eastman cartridge kodak camera. Exposure given, ½ second. Negative was developed in the regular way, using pyro-soda developer, without any alteration. The print was made on velvet velox. (See Page 125).

Study No. 5. Title, "The After Glow," by H. H. Boyce, Buffalo, N. Y. This picture was made at the close of a fine summer day, at 8 P. M. The lens used was a Century No. 3; focal length, 6 inches; stop used, wide open; exposure given, 2 seconds; plate used, Seed Regular 26 X; developed with metol-hydroquinon with no after manipulation; printing process, bromide enlargement to 10x12. (See Page 135).

Study No. 7. Title, "The Effort," by C. F. Clark, of Springfield, Mass. Was hung in the Fourth American Salon. This picture was made in the month of August; time of day, 10 A. M., with very bright sunlight. The lens used was a Cook lens; focal length, 13 inches; worked at stop f-8. Focus was made on the boy in the foreground; exposure given, ½ second; plate used, Orthonon; developer, ortol, and with no doctoring of the negative. (See Page 219).

Study No. 8. Title, "In the Gloaming," by Geo. H. Scheer, M. D., Sheboygan, Wis. Was hung in the Fourth American Salon. When making this picture, the weather was clear, but the heavens were slightly cloudy. Exposure

was made late in the afternoon, early in the month of June. Lens used, Rapid Rectilinear, worked wide open; plate used, was an Orthonon; exposure given, 1 second, with a Burke & James Ideal Ray Filter; plate was developed by tank development, with 25 minute formula pyro-soda. The negative was unaltered, but the print from which this reproduction was made, was an enlargement on royal bromide, slightly shaded to give upper portions a slightly longer exposure, and redeveloped in sodium sulphide, after only partially bleaching in weak solution of potassium bromide and ferricyanide. (See Page 235).

Study No. 9. Title, "Wading the Stream," by John Chislett, Indianapolis, Ind. Exposure was made on a bright August day, about 5 P. M., with a Smith lens, full opening. The plate used was a Cramer instantaneous isochromatic. A cap exposure was made, about ½ second; the negative was developed in ortol, and there was no altering of the negative after development. Print was made on platinum paper, with the foreground slightly darkened in the printing, and the high-lights and sky worked in on the back of the negative. (See Page 249).

Study No. 10. Title, "A Winter Stream," by R. E. Weeks, Chicago, Ill. Hung in the Third American Salon. This picture was made in the month of March, at 10 A. M., with weather conditions quite bright. The lens used was a Ross Homocentric, 3¼x4¼; focal length, 5½ inches; stop used, wide open; exposure given, 1-5 second, through Burke & James Isochrome Filter; plate used, film pack 3¼x4¼; developed in rodinal-hydroquinon. The diffused focus was obtained by focusing on foreground. The printing process was an 11x14 enlargement on Eastman platinoid bromide, and the picture was mounted on a cream margin

sepia mount, backed with a carbon black mount. (See Page 297).

Study No. 11. Title, "January Frost," by Sweet Brothers, Minneapolis, Minn. Hung in the Fifty-Second Annual Exhibition of the Royal Photographic Society of Great Britain. This picture was made under fleecy sunlight in January, at 4 P. M.; lens used was Zeiss, stopped at f/128; plate used, Seed Double-coated Orthonon; exposure given, 2 seconds; developed with eikonogen-hydroquinon, with no after treatment. Plate was made on velox, mounted on Scotch gray card. (See Page 339).

APPENDIX.

"American Annual" Table of Symbols, Atomic Weight and Solubilities of the Principal Chemicals used in Photography.

Abbreviations.—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

Name.	Symbol.	Molecular Weight.	One Part is Soluble in Cold Water	One Part is Soluble in Hot Water	Alcohol.
Acid, Acetic	$C_2H_4O_2$	60	in any proportion.		
" Boric or Boracic	H_3BO_3	62	25	3	6
" Carbolic (see Phenol)	C_6H_6O	94	16.6	3	6
" Citric	$C_6H_8O_7+H_2O$	210	0.75	0.5	s.
" Digallic (see Tannin)	$C_{14}H_{10}O_9$	322	0.8	0.5	0.8
" Gallic	$C_7H_6O_5$	170	100	3	8
" Hydrobromic	HBr	81	s.	s.	s.
" Hydroiodic	HI	128	s.	s.	s.
" Hydrochloric	HCl	36.5	s.	s.	s.
" Hydrofluoric	HFl	20	s.	s.	s.
" Hydrocyanic	HCy or CN	27	s.	s.	s.
" Hydro-sulphuric	H_2S	34	s.	s.	s.
" Muriatic (see Hydrochloric)	.....	.....	.....	.....	.....
" Nitric	HNO_3	63	in all proportions.		
" Nitrous	HNO_2	47	absorbed.		.....
" Oxalic	$C_2H_2O_4+2H_2O$	126	8	0.2	s. also in ether
" Pyrogallic (see Pyrogallol)	$C_6H_6O_3$	126	2	v. s.	also v. s. in ether.
" Salicylic	$C_7H_6O_3$	138	7.6	9	also v. s. in ether.

Acid, Sulphuric	H_2SO_4	98	in any proportion.		
" Sulphurous	H_2SO_3	82	absorbed.		
" Tannic (see Digallic)					
" Tartaric	$C_4H_6O_6$	150	0.8	0.5	5
Alcohol, Ethyl	C_2H_6O	46	in all proportions.		
Alcohol, Methyl (see Wood Alcohol)	CH_4O	32	in all proportions.		
Alum (see Potassium Aluminium Sulphate)	$Al_2(SO_4)_3K_2SO_4+24H_2O$	948.8	10	8	n. s.
Alum Chrome (see Potassium Chromic Sulph.)	$Cr_2(SO_4)_3K_2SO_4+24H_2O$	998.4	10	dec.	n. s.
Amidol (Diamido Phenol)	$C_6H_8N_2O$	124	very soluble.		
Ammonia, Gaseous	NH_3	17	very soluble.		
Ammonium Bichromate	$(NH_4)_2Cr_2O_7$	252	v. s.	v. s.	
" Bromide	NH_4Br	98	1.29	0.7	31.5
" Cadmium Bromide	$2NH_4Br2CdBr_2+H_2O$	678	0.73		5.3
" " Iodide	$2NH_4ICdI_2+2H_2O$	545	0.58		0.7
" Chloride	NH_4Cl	53.5	3	1	sp. s.
" Ferric Oxalate	$Fe_2(C_2O_4)_6(NH_4)_6+8H_2O$	892	2.1	0.29	sp. s.
" Fluoride	NH_4Fl	37	v. s.	v. s.	sp. s.
" Iodide	NH_4I	145	1	0.5	s.
" Nitrate	NH_4NO_3	80	2	1	s.
" Oxalate	$(NH_4)_2C_2O_4$	124	4	2	s.
" Persulphate	$(NH_4)SO_4$				
" Sulpho-Cyanate	NH_4CNS	76	s.	s.	s.
Aurantia (Hexanitro-diphenylamin Ammonia)	$NH_4C_{12}H_4(NO_2)_6N$	456			
Aurin (Trioxy-triphenyl Carbinol)	$C_{19}H_{14}O_3$	290			
Barium Chloride	$BaCl_2+2H_2O$	244	2.18	1.5	sp. s.
" Nitrate	$Ba(NO_3)_2$	261	12.2	2.84	n. s.
" Per-oxide	BaO_2	169	v. s.	n. s.	n. s.
Benzole or Benzine (Trioxy-tryphenyl-Carbinol)	C_6H_6	78	n. s.	n. s.	s.
Borax (see Sodium Biborate)					
Cadmium Bromide	$CdBr_2+4H_2O$	344	1.5	1	sp. s.
" Iodide	CdI_2	366	1.5	1	s.
Calcium Bromide	$CaBr_2$	200	1	.75	s.
" Carbonate (see Chalk)	$CaCO_3$	100	n. s.	n. s.	n. s.
" Chloride	$CaCl_2+6H_2O$	219	.75	5	10

TABLE OF SYMBOLS, ATOMIC WEIGHT AND SOLUBILITIES OF THE PRINCIPAL CHEMICALS USED IN PHOTOGRAPHY.

Abbreviations.—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

Name.	Symbol.	Molecular Weight.	One Part is Soluble in Cold Water	One Part is Soluble in Hot Water	Alcohol.
Calcium Hypochlorite (see Chloride of Lime)	$CaCl_2O_2CaCl_2$(?)	254	sp. s.	sp. s.	dec.
Calomel (see Mercurous Chloride)					
Camphor	$C_{10}H_{16}O$	152	1000		v. s.
Caustic Potash (see Potassium Hydrate)					
" Soda (see Sodium Hydrate)					
Chalk (see Calcium Carbonate)					
Chinoline Blue or Cyanine	$C_{29}H_{35}NaI$	533	sp. s.	sp. s.	s.
" Red	$C_{26}H_{19}NaCl$	389.5			
Chloride of Lime (see Calcium Hypochlorite)					
Chlorine	Cl	35.5	absorbed by 1 to 2.5 vols.		
Chloroform	$CHCl_3$	119.5	sp. s.	sp. s.	v. s.
Chrome-Alum (see Alum Chrome)					
Copper Acetate (see Verdigris)	$Cu(C_3H_3O_2)_2+H_2O$	223.4	14	5	1 in 14
" Bromide	$CuBr_2$	223.4	1	.75	s.
" Chloride	$CuCl_2+H_2O$	152.4	1	.75	v. s.
" Sulphate (see Blue Vitriol)	$CuSO_4+5H_2O$	249.4	3	1	n. s.
" " and Ammonia	$CuSO_4+4NH_3+H_2O$	245.4	s.	v. s.	n. s.
Corrosive Sublimate (see Mercuric Chloride)					
Dextrine	$C_6H_{10}O_5$	162	easily s.		n. s.
Eikonogen (Amido-β-Naphthol-β-Monosulphonate of Sodium)	$C_{10}H_8SO_4NaN$	261	40	e. s.	s.
Eosine, Yellow Shade (Tetra Bromo-fluoresceine Potassium)	$C_{20}H_6Br_4O_5K_2$	724	s.	s.	s.

Eosine, Red Shade (Tetra Brom.-fluores. Sod.)	$C_{20}H_6Br_4O_5Na_2$	692	s.	s.	s.
Epsom Salt (see Magnesium Sulphate)	.....	.....	.....	.....	.....
Erythrosine M. (Tetra Iodo-fluoresceine Potassium or Sodium)	$C_{20}H_6I_4O_5K_2$ or Na_2	912 or 880	s.	s.	s.
Erythrosine G. (Di-iodo-fluoresceine Potassium or Sodium)	$C_{20}H_6I_2O_5K_2$ or Na_2	658 or 626	s.	s.	s.
Gelatine, Glutine	Unobtainable	.....	sp. s.	e. s.	n. s.
Glycerine	$C_3H_8O_3$	92	in all proportions.		
Glycine (Oxy-phenylglycine)	$C_8H_9O_3N$	162	.....	.....	.....
Gold, Neutral Chloride	$AuCl_3$	302.5	1	5	also in ether.
" and Cadmium Chloride	$AuCl_5Cd$	485.5	s.	s.	s.
" and Potassium Chloride	$AuCl_4K+5H_2O$	467	s.	s.	s.
" and Sodium Chloride	$AuCl_4Na+2H_2O$	397	s.	s.	s.
" Sodium Hypo-sulphite	$AuNa_3S_4O_6+2H_2O$	525	s.	s.	s.
Gun Cotton (Tetra-nitrate Cellulose)	$C_{12}H_{16}O_6(NO_3)_4$	504	n. s.	n. s.	} in ether
" " (Tri-nitrate Cellulose)	$C_{10}H_{17}O_7(NO_6)_3$	579	n. s.	n. s.	} alcohol
Hydroquinone	$C_6H_6O_2$	110	s.	s.	also in ether.
Hydroxylamine Hydrochlorate	NH_3OHCl	69.5	0.6	e. s.	4
Iodine	I	127	sp. s.	sp. s.	e. s.
Iridium Tetra Chloride	$IrCl_4$	335	.....	.....	.....
Iron, Ammonium Sulphate	$FeSO_4(NH_4)_2SO_4+6H_2O$	392	v. s.	dec.	n. s.
" Chloride (Ferric)	Fe_2Cl_6	325	.75	.5	1 in 1
" Chloride (Ferrous)	Fe_2Cl_2	127	2	1	1 in 1
" Citrate	$Fe_2(C_6H_5O_7)_2$	490	s.	s.	n. s.
" Citrate and Ammonium	$Fe_2(C_6H_5O_7)_2+(NH_4)_3$	544	s.	s.	sp. s.
" Iodide	FeI_2+4H_2O	382	v. s.	v. s.	v. s.
" Nitrate	$Fe(NO_3)_2+6H_2O$	288	v. s.	dec.	dec.
" Oxalate (Ferric)	$Fe_2(C_2O_4)_3$	376	s.	s.	n. s.
" " (Ferrous)	FeC_2O_4	144	in potassium oxal.		n. s.
" Sulphate (Ferric)	$Fe_2(SO_4)_3+9H_2O$	566	s.	dec.	s.
" " (Ferrous)	$FeSO_4+7H_2O$	278	1.5	1	n. s.
Kaoline	$Al_2Si_2O_7+2H_2O$	258.8	not soluble.		.....
Lead, Acetate (see Sugar of Lead)	$Pb(C_2H_3O_2)_2$	325	2.5	2	1 in 12.5
" Carbonate	$PbCO_3$	267	n. s.	sp. s.	n. s.
" Iodide	PbI_2	461	s.	s.	n. s.

TABLE OF SYMBOLS, ATOMIC WEIGHT AND SOLUBILITIES OF THE PRINCIPAL CHEMICALS USED IN PHOTOGRAPHY.

Abbreviations.—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

Name.	Symbol.	Molecular Weight.	One Part is Soluble in Cold Water	One Part is Soluble in Hot Water	Alcohol.
Lead, Nitrate	$Pb(NO_3)_2$	331	7.7	7	s.
" Oxide	PbO	223	n. s.	n. s	Alkalis.
Lithium, Bromide	LiBr	87	.66	.5	v. s.
" Chloride	$LiCl+H_2O$	60.5	1.3	1	s.
" Iodide	$LiI+3H_2O$	188	.61	.5	s.
Magnesium, Bromide	$MgBr_2$	184.4	1	.75	s.
Magnesium, Chloride	$MgCl_2$	95.4	2	1.5	s.
" Iodide	MgI_2	278.4	1	.75	v. s.
" Sulphate (see Epsom Salt)	$MgSO_4,7H_2O$	246.4	1.3	1	sp. s.
Manganous Chloride	$MnCl_2+4H_2O$	198	s.	s.	n. s.
Mercury, Chloride (Mercuric) (see Corr. Subl.)	$HgCl_2$	271	19	3	5
" " (Mercurous) (see Calomel)	Hg_2Cl_2	471	n. s.	n. s.	n. s.
" Cyandie	$HgCy_2$ or $(CN)_2$	252	8	2	1 in 20
" Iodide (Mercuric)	HgI_2	454	sp. s.	sp. s.	sp. s.
" " (Mercurous)	Hg_2I_2	654	n. s.	n. s.	n. s.
Metol (Mono-methyl Para-amidometakresol)	$C_8H_{11}NO$	137	s.	s.	s.
Para-amidophenol	C_6H_7NO	109	sp. s.	s.	.....
Para-amidophenol Sodium	C_6H_6NaNO	131	easily	soluble.	.....
Para-amidophenol Hydrochlorate	C_6H_7NOHCl	145.5	s.	s.	s.
Para-rosaniline (Triamido-phenyl-Carbinol)	$C_{19}H_{19}N_3O$	305	.....	.....	.....
Phenol (see Carbolic Acid)	.....	.....	.....	.....	.....
Platino-potassium Chloride or Chloro-platinite	K_2PtCl_4	417.4	6	.....	s.

Platino-sodium Chloride or Chloro-platinite of Sodium	Na_2PtCl_4	385.4	soluble.		
Platinum Chloride	$PtCl_4+5H_2O$	429.4		*	
Potassa (see Potassium Hydrate)					
Potassium, Aluminium Sulphate (see Alum).					
" Bicarbonate	$KHCO_3$	100	3	2	n. s.
" Bichromate	$K_2Cr_2O_7$	294.4	10	7	n. s.
" Bromide	KBr	119	2	1	1 in 90
" Carbonate	K_2CO_3	138	.75	.5	n. s.
" Chlorate	$KClO_3$	122.5	16	2	n. s.
" Chloride	KCl	74.5	3	2	sp. s.
" Chromic Sulph. (see Chrome-Alum)					
" Citrate	$K_3C_6H_7O_8$	324	6.6	.3	n. s.
" Cyanide	KCy or (CN)	65	1	.5	sp. s.
" Ferric Sulphate	$K_2SO_4+Fe_2(SO_4)_3+24H_2O$	957	s.	s.	n. s.
" Ferri-cyanide (see Red Prussiate)	K_3FeCy_6	329.3	2.5	1.2	n. s.
" Ferro-cyanide (see Yellow Pruss.)	$K_4FeCy_6+3H_2O$	422	3	1	n. s.
" Fluoride	KFl	58	v. s.	v. s.	v. s.
" Hydrate	KOH	56	.5	.25	sp. s.
" Iodide	KI	166	.75	.5	1 in 16
" Nitrate (see Saltpetre)	KNO_3	101	4	1	n. s.
" Oxalate	$K_2C_2O_4+2H_2O$	202	3	2	sp. s.
" Permanganate	$KMnO_4$	158	16	10	n. s.
" Sulpho-cyanate	KCyS	97	2	1	sp. s.
Pyrogallol (see Pyrogallic Acid)					
Rhodan (German appellation for Cyanates)					
Rodinal (ready-prepared Para-amido Devel.)					
Silver, Acetate	$AgC_2H_3O_2$	167	sp. s.	sp. s.	n. s.
" Bromide	AgBr	188	n. s.	n. s.	in HCl and HBr.
" Carbonate	Ag_2CO_3	276	n. s.	n. s.	n. s.

* Real platinum-chloride is but little soluble in water; the article of commerce of that name answers to the formula $PtCl_4 2HCl+6H_2O$, and is of the atomic weight 520.4 (K. Schwier). It is easily soluble in water, probably in the proportion of 1.6.

TABLE OF SYMBOLS, ATOMIC WEIGHT AND SOLUBILITIES OF THE PRINCIPAL CHEMICALS USED IN PHOTOGRAPHY.

Abbreviations.— s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

Name.	Symbol.	Molecular Weight.	One Part is Soluble in Cold Water	One Part is Soluble in Hot Water	Alcohol.
Silver, Chloride	$AgCl$	143.5	n. s.	n. s.	Ammonia. cyan. potass. hypo-sulphite of soda.
" Citrate	$Ag_3C_6H_5O_7$	513	sp. s.	sp. s.	.....
" Fluoride	$AgFl$	127	v. s.	v. s.	v. s.
" Iodide	AgI	235	n. s.	n. s.	same as Chloride.
" Nitrate	$AgNO_3$	170	1	.5	sp. s.
" Nitrite	$AgNO_2$	154	300	dec.	n. s.
" Oxalate	$Ag_2C_2O_4$	302	sp. s.	s.	n. s.
" Oxide	Ag_2O	232	n. s.	n. s.	n. s.
" Sulphide	Ag_2S	248	n. s.	n. s.	n. s.
Soda, Caustic (see Sodium Hydrate)	.....	.....	.....	.....	.....
Sodium Acetate	$NaC_2H_3O_2+3H_2O$	136	3	.66	n. s.
" Biborate (Borax)	$Na_2B_4O_7+10H_2O$	382	12.5	2	n. s.
" Bromide	$NaBr$	103	1.25	1	1.16
" Bicarbonate	$NaHCO_3$	84	12	dec.	n. s.
" Carbonate	$Na_2CO_3+10H_2O$	286	2	1	n. s.
" Chloride	$NaCl$	58.5	2.75	2.75	n. s.
" Citrate	$Na_3C_6H_5O_7$	258	1	.5	sp. s.
" Hydrate	$NaHO$	40	1.5	.5	sp. s.
" Hypo-sulphite	$Na_2S_2O_3+5H_2O$	248	1.5	1	sp. s
" Iodide	NaI	150	.5	.3	sp. s
" Nitrate	$NaNO_3$	85	1.36	1	1 in 37

Sodium Sulph-antimoniate or Schlippe's Salt	Na_3SbS_4	317	s.	s.	n. s.
" Sulphate	$Na_2SO_4+10H_2O$	322	2	4	s.
" Sulphide	Na_2S+9H_2O	240	s.	s.	sp. s.
" Sulphite	$Na_2SO_3+7H_2O$	252	4	2	sp. s.
" Tungstate	$Na_2WO_4+2H_2O$	330	s.	s.	n. s.
" Thio-sulphate (see Hypo-sulphite)					
Strontium, Bromide	$SrBr_2+6H_2O$	355.5	1	.75	sp. s.
" Chloride	$SrCl_2+6H_2O$	266.5	1.8	1	sp. s.
Strontium, Nitrate	$Sr(NO_3)_2$	211.5	5	2	sp. s.
Sugar of Lead (see Lead Acetate)					
Tannin (see Digallic Acid)					
Thymol	$C_6H_3CH_3(C_3H_7)COO$	177	sp.		and in ether.
Tin, Chloride (Stannic)	$SnCl_4$	260	dec.	in much	water.
" Chloride (Stannous)	$SNCl_2+2H_2O$	225	135:100	655:100	v. s.
Uranium, Bromide	UBr_2+4H_2O	472	1	.5	sp. s.
" Nitrate	$UO_2(NO_3)_2+6H_2O$	504	.5	.25	v. s.
" Sulphate	$UO_2SO_4+3H_2O$	422	.5	.25	v. s.
Verdigris (see Copper Acetate)					
Vitriol, Blue (see Copper Sulphate)					
" Green (see Iron Sulphate)					
" White (see Zinc Sulphate)					
Water	H_2O	18			
Washing Soda (see Sodium Carbonate)					
Wood Alcohol (see Alcohol Methyl)					
Zinc, Bromide	$ZnBr_2$	225	del.	and e. s.	s.
" Chloride	$ZnCl_2$	136	.33		s.
" Iodide	ZnI_2	319	.33	dec.	v. s.
" Nitrate	$Zn(NO_3)_2+6H_2O$	297	del.	del.	del.
" Sulphate (see White Vitriol)	$ZnSO_4+7H_2O$	287	2	1	n. s.
Zircon Earth	ZrO_2	122	n. s.	n. s.	n. s.

TABLES OF THE SYMBOLS, CLASSES OR GROUPS.

Atomic and Equivalent Weights of the Elements.

NAME.	SYMBOL.	GROUP.	ATOMIC WEIGHT.	EQUIVALENT WEIGHT.
Aluminum	Al	III (IV)	27.4	13.7
Antimony (Stibium)	Sb	III (V)	120.0	120.0
Arsen	As	III (V)	75.0	75.0
Barium	Ba	II	137.0	68.5
Berryllium (Glucinum)	Be	II or III	9.4	4.7
Bismuth	Bi	III (V)	208.0	208.0
Boron	B	III (V)	11.0	11.0
Bromine	Br	I (III, V, VII)	80.0	80.0
Carbon	C	IV	12.0	6.0
Cadmium	Cd	II	112.0	56.0
Caesium	Cs	I	133.0	133.0
Calcium	Ca	II	40.0	20.0
Cerium	Ce	III (IV)	140.0	46.0
Chlorine	Cl	I (III, V, VII)	35.5	35.5
Chromium	Cr	IV (VI)	52.2	26.1
Cobalt	Co	II (IV)	58.8	29.4
Copper	Cu	II	63.4	31.7
Didymium	Di	III	145.0	
Erbium	E	III	166.0	
Fluorine	F	I	19.0	19.0
Gallium	Ga	IV	69.0	
Germanium	Ge	IV	72.2	
Glucinum	G	II	9.4	9.4
Gold	Au	I (III)	196.0	196.0
Hydrogen	H	I	1.00	1.00
Indium	In	III (IV?)	113.4	37.8
Iodine	I	I, III, V, VII	127.0	127.0
Iridium	Ir	II (IV, VI)	193.0	99.0
Iron	Fe	II (IV, VI)	56.0	28.0
Lanthanium	La	III	138.5	46.3
Lead (Plumbum)	Pb	II (IV)	207.0	103.5
Lithium	Li	I	7.0	7.0
Magnesium	Mg	II	24.4	12.2
Manganese	Mn	II (IV, VI, VII)	55.0	27.5
Mercury	Hg	II	200.0	100.0
Molybdenum	Mo	VI	96.0	46.0

Table of the Symbols, Etc.— *Continued.*

Name.	Symbol.	Group.	Atomic Weight.	Equivalent Weight.
Niobium (Columbium)	Nb	V	94.0	18.8
Nickel	Ni	II (IV)	58.8	29.4
Nitrogen	N	III (V)	14.0	14.0
Osmium	Os	II (IV,VI,VII)	199.0	99.5
Oxygen	O	II (IV?)	16.0	8.0
Palladium	Pd	(II, IV, VI)	106.0	53.25
Phosphorus	P	III (V)	31.0	31.0
Platinum	Pt	II (IV, VI)	196.0	98.7
Potassium (Kalium)	K	I	39.0	39.0
Rhodium	Rh	II (VI)	103.5	52.2
Rubidium	Rb	I (V)	85.4	85.4
Ruthenium	Ru	II(IV,VI,VIII)	101.4	52.2
Scandium	Sc	II (IV,VI,VII)	43.9	52.2
Selenium	Se	II (IV, VI)	79.0	39.7
Silicon (Silicium)	Si	IV	28.0	14.0
Silver (Argentum)	Ag	I	108.0	108.0
Sodium (Natrium)	Na	I	23.0	23.0
Strontium	Sr	II	87.5	43.7
Sulphur	S	II (IV, VI)	32.0	16.0
Tantalum	Ta	V	182.0	36.4
Tellurium	Te	II (IV, VI)	127.0	64.0
Thallium	Tl	I (III)	204 0	204.0
Thorium	Th	IV	232.5	57.87
Tin (Stannum)	Sn	II, IV	118.0	59.0
Tugsten (Wolfram)	W	IV, VI	184.0	92.0
Uranium	U	VI (IV)	240.0	60.0
Vanadium	V	III (V)	51.2	51.2
Ytterbium	Yt	IV	172.6	17.1
Yttrium	Y	II	89.5	30.85
Zinc	Zn	II	65.0	32.5
Zirconium	Zr	IV	90.0	44.8

ELSDEN'S TABLE OF POISONS AND ANTIDOTES.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Caustic Vegetable Alkalies, Acids.	Oxalic Acid. including Potassium Oxalate.	1 dram is the smallest fatal dose known.	Hot, burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting or magnesia, suspended in water. Plaster or mortar can be used in emergency.
	Ammonia. Potash. Soda.	Vapor of ammonia may cause inflammation of the lungs.	Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts.	Mercuric Chloride.	3 grains is the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	Acetate of Lead.	The sub-acetate is still more poisonous.	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia. Emetic of sulphate of zinc.
	Cyanide of Potassium.	*a*. Taken internally, 3 grs. fatal.	Insensibility, slow, gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over head and neck efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	Bichromate of Potas'um	*a*. Taken internally.	Irritant pain in stomach, and vomit'g.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troubleso'e sores and ulcers.	
	Nitrate of Silver.		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	Nitric Acid.	2 drams have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	Hydrochloric Acid.	½ ounce has caused death.		
	Sulphuric Acid.	1 dram has been fatal.		
	Acetic Acid, concentrated, has as powerful an effect as the mineral acids.			
	Iodine.	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged, and gruel, arrowroot and starch given freely.
	Ether.	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respira'n.
	Pyrogallol.	2 grains sufficient to kill a dog.	Resemble phosphorus poisoning.	No certain remedy. Speedy emetic desirable.

TREATMENT OF RESIDUES.

Nature of Waste.	Treatment.	Result of Operation.	Extraction of Precious Metal.
Old hypo and fixing baths.	Add a small quantity of a strong solution of potassium sulphide, and silver will be precipitated in the form of a dense brown flucculent cloud; which stir, and allow to settle.	Collect the resulting precipitate of sulphide of silver, and allow to dry.	Mix with equal weight of sodium carbonate, 2 parts, potassium nitrate, 1 part, and fuse in a crucible
Solid residues (cuttings of silver paper, old filters, etc.).	Burn.	Collect the ashes.	Mix with equal weight of sodium carbonate, 2 parts, potassium nitrate, 1 part, and fuse in a crucible.
Old combined toning and fixing sulphocyanide baths.	Add a small quantity of hydrochloric acid and ferrous sulphate, which give a precipitate of metallic gold mixed with hydrous perchloride of iron.	Collect, and dry.	Fuse in a crucible to collect the gold and silver.
Old platinotype baths (oxalate of potassium).	Add to each liter (1,000 cc.) of old oxalate bath, 330 c.c. of a concentrated solution of sulphate of iron, and heat to boiling point.	The resulting black precipitate is pure platinum.	Collect, wash well, and dry on a filter.
Acid-fixing baths (platinotype process).	Add ferrous developing solution.	Metallic platinum is formed (mixed with small quantity of iron).	Eliminate the iron by treating with sulphuric acid, then wash.
Silver from sensitive films.	Place sensitized plates, etc., in 100 cc. of hydrochloric acid; pour the whole into a beaker, and add 100 c.c. of sulphuric acid, and heat.	Silver forms at the bottom of the beaker; allow to settle, and decant.	The residue is mixed with 5 parts of charcoal and 70 parts of sawdust, and heated to bright red in a crucible for an hour. A button of silver will be found at the bottom after the operation.

CHARACTERISTICS OF THE PRINCIPAL PHOTOGRAPHIC DEVELOPERS.

Developer.	Color of Image.	Solubility.	Quantity Used in 1,000 c.c. of Water.	Used With.	Keeping Qualities.
Amidol.	Gray-black.	Soluble in water. Slightly soluble in alcohol.	5 grms.	Neutral sulphite soda and other alkalies.	Loses energy when it turns red.
Pyrocatechin (Kachin).	Bluish-gray.	Soluble in water, alcohol, and ether.	5 to 15 grms.	Alkaline carbonates.	Slowly turns brown.
Eikonogen.	Gray-blue.	Soluble in warm water. Very soluble in cold water. Almost insoluble in alcohol or ether.	10 to 30 grms.	Neutral sulphite with alkaline carbonates.	Turns brown when exposed to the air without losing its energy.
Glycin.		Very soluble in water and alcohol. Insoluble in ether.		Caustic alkalies and carbonates.	
Hydroquinone.	Brown-black.	Very soluble in warm water, alcohol and ether; less soluble in cold.	7 to 10 grms.	Caustic alkalies and carbonates.	Turns brown when exposed to the air without losing its energy.
Metol.	Gray-black.	Very soluble in water. Soluble in alcohol and ether.	5 grms.	Alkaline carbonates.	Keeps well.
Ortol.		Very soluble in water. Soluble in alcohol and ether.		Alkaline carbonates.	
Paramidophenol.	Bluish.	Very soluble in water. Slightly soluble in alcohol and ether.	10 to 25 grms.	Carbonates and caustic alkalies.	Keeps well.
Pyrogallic Acid.	Brown-yellow.	Very soluble in water, alcohol and ether.	5 to 10 grms.	Carbonates and ammonia.	Turns brown in the air.
Ferrous sulphate.	Yellowish.	Very soluble in water. Insoluble in alcohol.	100 to 300 grms.	Carbonates and ammonia.	Does not keep well.

UNITED STATES WEIGHTS AND MEASURES.

According to Existing Standards.

LINEAL.

	Inches.	Feet.	Yards.	Rods.	Fur's.	Mile.
12 inches = 1 foot.	12 =	1				
3 feet = 1 yard.	36 =	3 =	1			
5.5 yards = 1 rod.	198 =	16.5 =	5.5 =	1		
40 rods = 1 furlong.	7,920 =	660 =	220 =	40 =	1	
8 furlongs = 1 mile.	63,360 =	5,280 =	1,760 =	320 =	8 =	1

SURFACE — LAND.

	Feet.	Yards.	Rods.	Roods.	Acres.
144 sq. ins. = 1 sq. ft.					
9 sq. ft. = 1 sq. yard.	9 =	1 =			
30.25 sq. yds. = 1 sq. rod.	272.25 =	30.25 =	1		
40 sq. rods = 1 sq. rood.	10,890 =	1,210 =	40 =	1	
4 sq. roods = 1 acre.	43,560 =	4,840 =	160 =	4 =	1
640 acres = 1 sq. mile.	27,878,400 =	3,097,600 =	102,400 =	2,560 =	640

VOLUME — LIQUID.

4 gills = 1 pint.
2 pints = 1 quart.
4 quarts = 1 gallon.

Gills.	Pints.	Gallon.	Cub. In.
32 =	8 =	1 =	231

FLUID.

Gallon.	Pints.	Ounces.	Drachms.	Minims.	Cubic Centimetres.
1 =	8 =	128 =	1,024 =	61,440 =	3,785,435
	1 =	16 =	128 =	7,680 =	473,179
		1 =	8 =	480 =	29.574
			1 =	60 =	3,697

16 ounces, or a pint, is sometimes called a fluid pound.

TROY WEIGHT.

Pound.	Ounces.	Pennyweights.	Grains.	Grams.
1 =	12 =	240 =	5,760 =	373.24
	1 =	20 =	480 =	31.10
		1 =	24 =	1.56

APOTHECARIES' WEIGHT.

lb.	℥	ʒ	℈	gr.	
Pound.	Ounces.	Drachms.	Scruples.	Grains.	Grams.
1 =	12 =	96 =	288 =	5,760 =	373.24
	1 =	8 =	24 =	480 =	31.10
		1 =	3 =	60 =	3.89
			1 =	20 =	1.30
				1 =	.06

The pound, ounce, and grain are the same as in Troy weight.

AVOIRDUPOIS WEIGHT.

Pound.	Ounces.	Drachms.	Grains (Troy).	Grams.
1 =	16 =	256 =	7,000 =	453 60
	1 =	16 =	437.5 =	2.17
		1 =	27.34 =	53.87

ENGLISH WEIGHTS AND MEASURES.

Apothecaries' Weight.

20 Grains	= 1 Scruple	=	20 Grains.
3 Scruples	= 1 Drachm	=	60 Grains.
8 Drachms	= 1 Ounce	=	480 Grains.
12 Ounces	= 1 Pound	=	5760 Grains.

FLUID MEASURE.

60 Minims	= 1 Fluid Drachm.
8 Drachms	= 1 Fluid Ounce.
20 Ounces	= 1 Pint.
8 Pints	= 1 Gallon.

The above weights are usually adopted in formulæ.

All Chemicals are usually sold by

Avoirdupois Weight.

27 11/32 Grains	= 1 Drachm	=	27 11/32 Grains.
16 Drachms	= 1 Ounce	=	437½ Grains.
16 Ounces	= 1 Pound	=	7000 Grains.

Precious Metals are usually sold by

Troy Weight.

24 Grains	= 1 Pennyweight	=	24 Grains.
20 Pennyweights	= 1 Ounce	=	480 Grains.
12 Ounces	= 1 Pound	=	5760 Grains.

Note.—An ounce of metallic silver contains 480 grains, but an ounce of nitrate of silver contains only 437½ grains.

United States Fluid Measure.

Gal.	Pints.	Ounces.	Drachms.	Mins.	Cub. In.	Grains.	Cub. C. M.
1 =	8 =	128 =	1,024 =	61,440 =	231. =	58,328.886 =	3,785.44
1 =	16 =	128 =	7,680 =	28.875 =	7,291.1107 =	473.18
1 =	8 =	480 =	1.8047 =	455.6944 =	29.57
1 =	60 =	0.2256 =	56.9618 =	3.70

Imperial British Fluid Measure.

Gal.	Pints.	Ounces.	Drachms.	Mins.	Cub. In.	Grains.	Cub. C. M.
1 =	8 =	160 =	1,280 =	76,800 =	277.27384 =	70,000 =	4,543.732
1 =	20 =	160 =	9,600 =	34.65923 =	8,750 =	567.966
1 =	8 =	480 =	1.73296 =	437.5 =	28.398
1 =	60 =	0.21662 =	54.96 =	3.550

METRIC SYSTEM OF WEIGHTS AND MEASURES.

MEASURES OF LENGTH.

Denominations and Values.		Equivalents in Use.	
Myriameter	10,000 meters.	6.2137	miles.
Kilometer	1,000 meters.	.62137	mile, or 3,280 ft. 10 in.
Hectometer	100 meters.	328.	feet and 1 inch.
Dekameter	10 meters.	393.7	inches.
Meter	1 meter.	39.37	inches.
Decimeter	1-10th of a meter.	3.937	inches.
Centimeter	1-100th of a meter.	.3937	inch.
Millimeter	1-1000thof a meter.	.0394	inch.

MEASURES OF SURFACE.

Denominations and Values.		Equivalents in Use.	
Hectare	10,000 square meters.	2.471	acres.
Are	100 square meters.	119.6	square yards.
Centare	1 square meter.	1,550.	square inches.

MEASURES OF VOLUME.

Denominations and Values.			Equivalents in Use.	
Names.	No. of Liters	Cubic Measures.	Dry Measure.	Wine Measure.
Kiloliter or stere	1,000	1 cubic meter.	1.308 cubic yards.	264.17 gals.
Hectoliter	100	1-10th cubic meter.	2 bu. and 3.35 pecks.	26.417 gals.
Dekaliter	10	10 cubic decimeters.	9.08 quarts.	2.6417 gals.
Liter	1	1 cubic decimeter.	.908 quart.	1.0567 qts.
Deciliter	1-10	1-10th cu. decimeter.	6.1023 cubic inches.	.845 gill.
Centiliter	1-100	10 cubic centimeters.	.6102 cubic inch.	.338 fl. oz.
Milliliter	1-1000	1 cubic centimeter.	.061 cubic inch.	.27 fl. drm.

WEIGHTS.

Denominations and Values.			Equivalents in Use.
Names.	Number of Grams.	Weight of Volume of Water at its Maximum Density.	Avoirdupois Weight.
Millier or Tonneau	1,000,000	1 cubic meter.	2204.6 pounds.
Quintal	100,000	1 hectoliter.	220.46 pounds.
Myriagram	10,000	10 liters.	22.046 pounds.
Kilogram or Kilo	1,000	1 liter.	2.2046 pounds.
Hectogram	100	1 deciliter.	3.5274 ounces.
Dekagram	10	10 cubic centimeters.	.3527 ounce.
Gram	1	1 cubic centimeter.	15.432 grains.
Decigram	1-10	1-10th of a cubic centimeter.	1.5432 grain.
Centigram	1-100	10 cubic millimeters.	.1543 grain.
Milligram	1-1000	1 cubic millimeter.	.0154 grain.

For measuring surfaces, the square dekameter is used under the term of ARE; the hectare, or 100 ares, is equal to about 2½ acres. *The unit of capacity* is the cubic decimeter or LITER, and the series of measures is formed in the same way as in the case of the table of lengths. The cubic meter is the unit of measure for solid bodies, and is termed STERE. *The unit of weight* is the GRAM, which is the weight of one cubic centimeter of pure water weighed in a vacuum at the temperature of four deg. Cent. or 39.2 deg. Fahr., which is about its temperature of maximum density. In practice, the term cubic centimeter abbreviated c. c., is generally used instead of milliliter, and cubic meter instead of kiloliter.

Freezing Mixtures.

PARTS. Reducing the Temperature	From Degrees of the Celsius	To Thermometer
3 Nitrate of sodium + 4 Water	+ 13.2 deg.	— 5.3 deg.
9 Phosphate of sodium + 4 dilute Nitric acid.	+ 10 "	— 9 "
3 Sulphate of sodium + 2 dilute Nitric acid..	+ 10 "	—10 "
1 Nitrate of sodium + 4 Water		—10.6 "
1 Chloride of potassium + 4 Water		—11.8 "
5 Sal ammoniac + 5 Saltpetre + 16 Water	+ 10 deg.	—12 "
1 Nitrate of ammonia + 1 Water	+ 10 "	—15.5 "
8 Sulphate of sodium + 5 conc. Sulphuric acid	+ 10 "	—17 "
1 Sulphocyanate of Potass. + 1 Water	+ 18 "	—21 "
1 Chloride of sodium + 3 Snow		—21 "
1 Sal ammoniac + 1 Saltpetre + 1 Water	+ 8 deg.	—24 "
3 Crystal. chloride of calcium + 1 Snow		—36 "
1 Snow + 1 dilute Sulphuric acid	— 5 deg.	—41 "

Antidote for Metol Poisoning.

There is a serious drawback to the use of Metol, as with some people it brings on an irritating skin trouble, leaving the fingers very sensitive and tender.

As a cure for this trouble, the following is recommended:

Take first Rochelle Salts to open the bowels, and next day use Swift's Special Specific, (S. S. S.) according to directions for scrofula. Attention should be paid to the general health, any tendency toward dyspepsia and constipation at once to be checked.

The following ointment is good and very healing:

Ichthyol	1 dram.
Lanoline	2 drams.
Vaseline	3 drams.
Boracic Acid	2 drams.

A drop of oil of lavender destroys the odor of the ichthyol and lanoline, and makes the ointment pleasant. It should be well rubbed into the skin, and at nights a good plan is to wear cotton gloves so that the ointment will not rub off nor stain the clothing. The ointment is also good for cuts and burns.

Another remedy, which, however, is rather severe, is to soak the hands in a strong solution of salt and vinegar for fifteen minutes. Do this twice daily for three or four days.

To Remove Stains from the Hands.

DEVELOPMENT STAINS.— Yield easily to the action of lemon juice.

NITRATE OF SILVER STAINS.— Prepare a solution of water 100 cc.; chloride of lime, 25 grms.; sulphate of soda, 50 grms. Apply with a tooth-brush.

PYRO STAINS.— Wash stained parts with a 10-per-cent. solution of oxalic acid.

AMIDOL STAINS.— Difficult to remove. Try citric acid.

NITRIC ACID STAINS.— Apply to stained parts a solution of permanganate of potash. Then wash freely.

The Conversion of French (Metric) into English Measure.

1	cubic centimeter	=	17	minims.						
1	cubic centimeters	=	34	"						
3	"	=	51	"						
4	"	=	68	"	or	1	dram	8	minims.	
5	"	=	85	"	"	1	"	25	"	
6	"	=	101	"	"	1	"	41	"	
7	"	=	118	"	"	1	"	58	"	
8	"	=	135	"	"	2	drams	15	"	
9	"	=	152	"	"	2	"	32	"	
10	"	=	169	"	"	2	"	49	"	
20	"	=	338	"	"	5	"	38	"	
30	"	=	507	"	"	1	ounce	0	dram	27 minims.
40	"	=	676	"	"	1	"	3	drams	16 "
50	"	=	845	"	"	1	"	6	"	5 "
60	"	=	1014	"	"	2	ounces	0	"	54 "
70	"	=	1183	"	"	2	"	3	"	43 "
80	"	=	1352	"	"	2	"	6	"	32 "
90	"	=	1521	"	"	3	"	1	"	21 "
100	"	=	1690	"	"	3	"	4	"	10 "
1000	"	=	1 liter = 34 fluid ounces nearly, or $2\frac{1}{8}$ pints.							

The Conversion of French (Metric) into English Weight.

The following table, which contains no error greater than one-tenth of a grain, will suffice for most practical purposes:

1	gram	=	$15\frac{2}{5}$	grains.					
2	grams	=	$30\frac{4}{5}$	"					
3	"	=	$46\frac{1}{5}$	"					
4	"	=	$61\frac{4}{5}$	"	.....	or	1 dram	$1\frac{4}{5}$	grain.
5	"	=	$77\frac{1}{5}$	"	.....	"	1 "	$17\frac{1}{5}$	grains.
6	"	=	$92\frac{3}{5}$	"	.....	"	1 "	$32\frac{3}{5}$	"
7	"	=	108	"	.....	"	1 "	48	"
8	"	=	$123\frac{2}{5}$	"	.....	"	2 drams	$3\frac{2}{5}$	"
9	"	=	$138\frac{4}{5}$	"	.....	"	2 "	$18\frac{4}{5}$	"
10	"	=	$154\frac{2}{5}$	"	.....	"	2 "	$34\frac{2}{5}$	"
11	"	=	$169\frac{4}{5}$	"	.....	"	2 "	$49\frac{4}{5}$	"
12	"	=	$185\frac{1}{5}$	"	.....	"	3 "	$5\frac{1}{5}$	"
13	"	=	$200\frac{3}{5}$	"	.....	"	3 "	$20\frac{3}{5}$	"
14	"	=	216	"	.....	"	3 "	36	"
15	"	=	$231\frac{2}{5}$	"	.....	"	3 "	$51\frac{2}{5}$	"
16	"	=	247	"	.....	"	$\frac{1}{2}$ "	7	"
17	"	=	$262\frac{2}{5}$	"	.....	"	4 "	$22\frac{2}{5}$	"
18	"	=	$277\frac{4}{5}$	"	.....	"	4 "	$37\frac{4}{5}$	"
19	"	=	$293\frac{1}{5}$	"	.....	"	4 "	$53\frac{1}{5}$	"
20	"	=	$308\frac{3}{5}$	"	.....	"	5 "	$8\frac{3}{5}$	"
30	"	=	463	"	.....	"	7 "	43	"
40	"	=	$617\frac{1}{5}$	"	.....	"	10 "	$17\frac{1}{5}$	"
50	"	=	$771\frac{3}{5}$	"	.....	"	12 "	$51\frac{3}{5}$	"
60	"	=	926	"	.....	"	15 "	26	"
70	"	=	$1080\frac{4}{5}$	"	.....	"	18 "	$0\frac{4}{5}$	"
80	"	=	$1234\frac{3}{5}$	"	.....	"	20 "	$34\frac{3}{5}$	"
90	"	=	1389	"	.....	"	23 "	9	"
100	"	=	$1543\frac{1}{5}$	"	.....	"	25 "	$43\frac{1}{5}$	"
1000	"	=	1 kilogram = 32 oz., 1 dr., $12\frac{2}{5}$ gr.						

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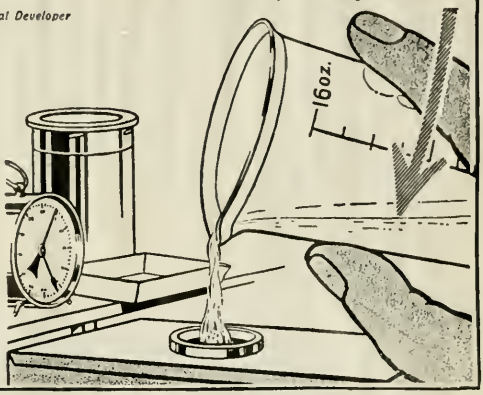

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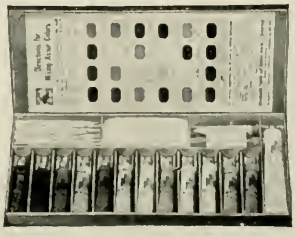

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